RAID INCORPORATED

Falcon IV

RAID Subsystem Series

Hardware Manual

Rev. 2.0 (2009)

Warnings and Certifications

RESTRICTED ACCESS LOCATION:

This equipment is intended to be installed in a RESTRICTED ACCESS LOCATION only.

- Access can only be gained by SERVICE PERSONS or by USERS who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and
- Access is by an authorized person through the use of a TOOL or lock and key, or other means of security, and is controlled by the authority responsible for the location.

ELECTRIC SHOCK WARNING!

To Prevent Electric Shock:

1. Access to this equipment is granted only to trained operators and service personnel who have been instructed of and fully understand the possible hazardous conditions and the consequences of accessing non-field-serviceable units, e.g., system backplane or power supplies.
2. Unplug the system before you move it or when it has become damaged.

RELIABLE EARTHING!

Particular attention should be given to prepare reliable earthing with the power supply connections other than direct connections to the branch circuit (e.g., use of power strips). The AC power cords provide the main earth connection. Check proper grounding before powering on the enclosure.

OVERLOADING PROTECTION!

1. The enclosure should be installed according to specifications on a chassis label. Provide a suitable power source with electrical overload protection.
2. Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.

BATTERY USE WARNING!

Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to local ordinance.

THERMAL PRECAUTIONS:

1. If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Appropriate measures, such as increasing airflow, should be available to maintain the temperature below 35°C.
2. The openings on the enclosure are for air convection. DO NOT COVER THE OPENINGS.
3. To comply with safety, emission, and thermal requirements, all module bays should be populated with plug-in modules. The system should not be operated with the absence of any covers.

HANDLING PRECAUTIONS:

1. The system can either be installed into a standard EIA-310 19” rack cabinet or placed on a desktop. Mechanical loading of the enclosure should be carefully handled to avoid hazardous condition. A drop or fall could cause injury.
2. Lay this system on a reliable surface with desktop installation. A drop or fall can cause injury.
3. Mounting this enclosure requires two people.
4. The enclosure can weigh up to 34.4lb (15.64kg) without disk drives. With disk drives loaded, the enclosure can weigh up to 52.4lb (24kg). A reliable surface should be available to support this weight.
5. Disk drives should be installed after the enclosure is securely installed.

FCC (applies in the U.S. and Canada)

FCC Class A Radio Frequency Interference Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING:

A shielded power cord is required in order to meet FCC emission limits and also to prevent interference to nearby radio and television reception.

Use only shielded cables to connect I/O devices to this equipment. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

CE This device is in conformity with the EMC.

CB **(Certified Worldwide)**

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.

CCC For Power Supplies' compatibility to China Compulsory Certification.

China RoHS

In Compliance with AeA China RoHS Regulations (SJ/T 11364-2006)

有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr6+)	多溴联苯(PBB)	多溴二苯醚(PBDE)
PCBA	X	O	O	O	O	O
机壳机架	X	O	O	O	O	O

O:表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006规定的限量要求以下。
X:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006规定的限量要求。

说明 :
于PCBA部分:
1. 主动(半导体)组件: 高熔点焊料合金中含有铅
2. 被动组件:电子陶瓷组件含有铅
3. 组件脚(脚距小于0.65mm之主、被动组件及连接器)含有铅
4. LCD模块所使用的光学玻璃含有铅

于机壳机架部分:
机壳机架中的钢合金、铝合金及铜合金含有铅

* 上述项目皆碍于技术上不够成熟、经济上及可靠度上不可行而含有过量有毒物质

D33225

ITE BSMI Class A, CNS 13438 (for Taiwan)

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

This device is in conformity with UL standards for safety.

M004

Инструкция по безопасности

Модель:
FC to SAS/SATA 3U/16, 4U/24 Bay RAID Subsystem, Models
Falconxxxxxx, Falconxxxx, Falcon, Falcon
where "x" can be "0-9", "A-Z", blank, or dash "x" for marketing
purpose and no impact safety related critical components and constructions.

1. Перед использованием оборудования внимательно прочтите инструкцию.
2. Сохраняйте инструкцию для дальнейшего использования в работе.
3. Не допускайте попадания влаги на изделие.
4. Устанавливайте оборудование на устойчивую поверхность. Падение может нанести ущерб оборудованию.
5. Соблюдайте климатические требования, использование оборудование при температуре окружающей среды выше 50°C, может привести к выходу оборудования из строя.
6. Размещайте шнур питания в недоступном для пользователя месте. Запрещается ставить на шнур питания какие-либо предметы.
7. При работе с оборудованием необходимо учитывать все предупреждения и замечания.
8. Если оборудование не используется в течении длительного времени, отключите его от сети питания.

9. Запрещается вскрывать оборудование. Оборудование может вскрываться только квалифицированным персоналом.
10. При возникновении одного из повреждений оборудования вызовите обслуживающий персонал:
    a. Повреждение шнура питания или вилки.
    b. Оборудование не работает или его работа не соответствует инструкции пользователя .
    e. Оборудование повреждено.
    f. Оборудование имеет очевидный признак поломки.
11. Источник питания должен быть установлен в соответствии с инструкцией. Ток нагрузки и выходная мощность не должны превышать указанных в спецификации.

RAID, Inc. is committed to being properly prepared and taking all the necessary steps that will result in our compliance with the new European directive, RoHS (2002/95/EC), on or before the specific dates set forth in those applicable laws and regulations. RAID, Inc is applying its own internal efforts and expertise and is working closely with customers and suppliers to achieve compliance while maintaining an uninterrupted supply of quality products. RAID, Inc is currently investigating, evaluating, and qualifying our materials and components to ensure that products sold on or after 1 July 2006, in such territory, are in compliance with the above regulations.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By proper waste handling of this product you ensure that it has no negative consequences for the environment and human health, which could otherwise be caused if this product is thrown into the garbage bin. The recycling of materials will help to conserve natural resources.

For more details about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

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Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.

- If it is necessary to transport the subsystem, repackage all disk drives separately in the drive trays and in the original package foam blocks. If using the original package material, other replaceable modules can stay within the enclosure.

- The Falcon IV subsystems come with 12, 16, or 24 drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.

- If a module fails, leave it in place until you have a replacement unit and you are ready to replace it.

- Airflow Consideration: The subsystem requires an airflow clearance, especially at the front and rear. A clearance of at least 18 to 20 centimeters is required at the rear side and any objects blocking the exhaust airflow, e.g., cables dangling at the fan outlet, should be avoided.

- Handle subsystem modules using the retention screws, eject levers, and the metal frames/face plates. Avoid touching PCB boards and connector pins.

- To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that all enclosure modules and covers are securely in place during operation.

- Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.

- Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.

- If it is necessary to transport the subsystem, repackage all drives separately.

- Dual-redundant controller models come with two RAID controllers that should always be present. Single-controller models come with a single RAID controller and a metal sheet is placed over the lower controller bay at the rear of the subsystem. Since single-controller models cannot be upgraded, this metal sheet should NEVER be removed.

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad are recommended. Avoid dust and debris in your work area.

About This Manual

This manual:

- Introduces the Falcon IV storage system series.
- Describes all major components in the system.
- Provides recommendations and details about the hardware installation process.
- Describes how to monitor system operating statuses.
- Describes how to maintain the subsystem.

This manual does not:

- Describe components that are not user-serviceable.
- Describe the configuration options of firmware, using terminal emulation programs, or the SANDWatch GUI that came with your subsystem.
- Give a detailed description of the RAID processing units or the RAID controllers within the subsystem.

Revision History

Rev. 1.0: Initial release.

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentation

- Generic Operation Manual (firmware operation via LCD keypad and terminal emulation)
- Falcon IV Series Configuration Planning Guide

- Troubleshooting Guide
- SANWatch User's Manual
- Embedded RAIDWatch User's Manual
- LCD Keypad Navigation Map
- Quick Installation Guide

These two (2) documents are included in the product utility CD that came with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the Falcon IV series is referred to as simply the "subsystem" or the "system" and RAID, Inc is sometimes abbreviated as "IFT."

Important Messages

Important messages appear where mishandling of components is possible or when work order can be mis-conceived. These messages also provide important information associated with other aspects of system operation. The word "important" is written as "**IMPORTANT**," both capitalized and bold and is followed by text in italics. The italicized text is the message to be delivered.

Warnings

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously. Warnings are easy to recognize. The word "warning" is written as "**WARNING**," both capitalized and bold and is followed by text in italics. The italicized text is the warning message.

Cautions

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system. Cautions are easy to recognize. The word "caution" is written as "**CAUTION**," both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Notes

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes. Notes are easy to recognize. The word “note” is written as “**NOTE**,” both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot “•.”

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Software and Firmware Updates

Please contact your system vendor or visit RAID, Inc’s FTP site (ftp.raidinc.com).
NOTE that the firmware version installed on your system should provide the complete functionality listed in the specification sheet/user’s manual.
We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do.

Problems that occur during the updating process may cause irrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

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Chapter 1

Introduction

1.1 Product Overview

1.1.1 Introduction

This chapter introduces the Falcon FC-to-SAS/SATA-II storage system. The Falcon IV system comes with two (2) 8Gb Fibre Channel host ports on each of dual-active RAID controllers and delivers fast I/O performance for applications in a Storage Area Network (SAN).

Figure 1-1: Falcon IV System

The Falcon's 8Gb FC host interfaces support backward compatibility with 4G or 2G Fibre Channel devices. With the 8Gb/s channel throughput, the system is ideal for virtualized server and various applications requiring I/O intensive operations. Powered by a 6th-generation ASIC667 RAID engine and a dual-CPU core design, the Falcon delivers twice the read performance, one half more on write performance, and significant enhancement on I/Os per second than its ASIC400 predecessors. Built around a pure PCI-E architecture, the Falcon also excels in throughput-intensive applications.

The system delivers extreme performance that results from the combined performance of multiple disk drives, the level of data protection, and adaptability unseen elsewhere in a 4U profile. Featuring all RAID, Inc's well-acclaimed RAID reliability, the Falcon system provides a reliable platform for a wide variety of storage operations such as disk farm, data-mining, postproduction editing, broadcasting, or strategically shared storage over SAN.

The Falcon IV series models now use common components, e.g., PSU and CBM, to minimize logistic efforts. The traditional battery backup is replaced by an innovative CBM (Cache Backup Module) methodology. Cached data is transferred to flash module with the support of BBU in the event of power outage. Because of a shorter discharge time, BBU life expectancy is extended to 3 years, and data

is safely kept in flash regardless of the traditional 72 hours limitation from battery capacity.

Along with the 80+ efficiency PSUs, the embedded firmware features intelligent algorithms, such as power-saving modes and exiled drive handling, making this model a greener choice.

This Falcon system is housed in a 4U-profile chassis featuring a high-density architecture that supports up to twenty-four (24) hot swappable, 3Gb/s SAS or SATA-II hard drives. The system is managed by active-active or a single RAID controller. The default 1GB DDR-II memory can be upgraded to a 2GB capacity module to support complicated applications that hold numerous ID/ LUN combinations.

In addition to the ease of implementation, the Falcon also supports capacity expansion via its SAS links by attaching up to five JBODs If using 1TB size SATA drives in a combination of single-controller RAID and JBOD, a configuration can reach a maximum capacity of 104TB.

Model Variations

Model	Controllers	Controller Configuration	Host Ports
Falcon IV	Falcon IV	Redundant	4
Falcon IV	Falcon IV	Single	2

- **Falcon IV :** This model comes with redundant RAID controllers. The dual-controller configuration corresponds with SAS drives' dual-ported design and each manages a separate SAS domain for higher fault tolerance. The dual-controller model supports all necessary features such as synchronized cache and the transparent failover/failback capability.

- **Falcon IV :** The Falcon IV comes with a single RAID controller. This model can not be upgraded into a dual-redundant configuration by adding a partner RAID controller. Except for controller redundancy, the single-controller configuration supports all advanced RAID technologies and fault tolerance by redundant configuration of other modules.

1.1.2 Enclosure Chassis

1.1.2.1 Chassis Overview

The Falcon IV RAID storage is housed in a 4U robust chassis that is divided into the front and the rear sections. Key components are either accessed through the front or rear panels. The enclosure chassis can be mounted into a standard EIA, 19-inch rack or enclosure cabinet using support brackets that are included in kit.

1.1.2.2 Physical Dimensions

The Falcon IV comes in a 4U chassis with the following dimensions:

- **With forearm handles**: 482W x 174.4H x 514D mm (19 x 6.87 x 20.2 inches)
- **Without forearm handles**: 445W x 174.4H x 498D mm (17.5 x 6.87 x 19.6 inches)

1.1.2.3 Front Panel Overview

The front section of the system features a 4x4 layout for 24 3.5-inch disk drives. The forearm handles enable you to easily extract the chassis from a rack or cabinet. The front view is shown below. A description of each front panel component is given below:

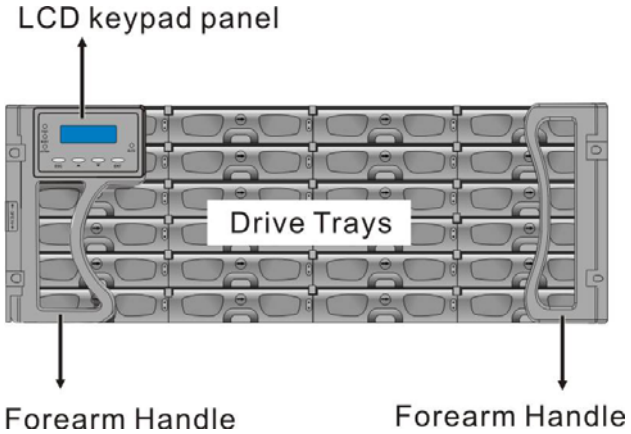


Figure 1-2: Falcon IV Front View

The front panel components include:

- **Drive bays with drive tray canisters:** The drive bays accommodate either SAS or SATA-II 3.5" disk drives.
- **Forearm handles:** For retrieving chassis from a rack cabinet.

1.1.2.4 Hard Drive Numbering

The front section of the Falcon IV enclosure houses 24 hard drives in a 4x4 configuration. When viewed from the front, the drive bays (slots) are numbered 1 to 24 from left to right and then from top to bottom.

Slot 1	**Slot 2**	**Slot 3**	**Slot 4**
Slot 5	**Slot 6**	**Slot 7**	**Slot 8**
Slot 9	**Slot 10**	**Slot 11**	**Slot 12**
Slot 13	**Slot 14**	**Slot 15**	**Slot 16**
Slot 17	**Slot 18**	**Slot 19**	**Slot 20**
Slot 21	**Slot 22**	**Slot 23**	**Slot 24**

Knowing the tray numbering sequence is extremely important should you need to replace a failed drive. If a RAID5 array already has a failed drive, and you accidentally remove the wrong drive, data will be lost.

1.1.2.5 Rear Panel Overview

A rear view of the system is shown below. Descriptions of each rear panel component are given in the following sections:

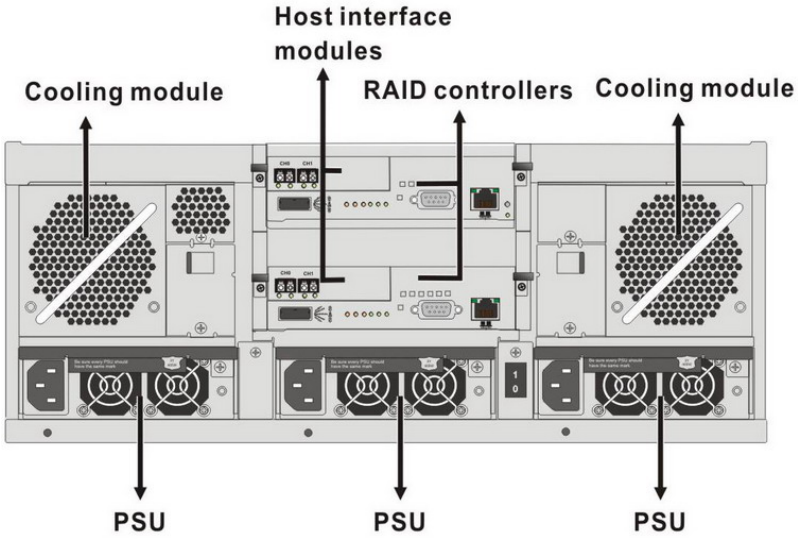


Figure 1-3: Falcon IV Rear View

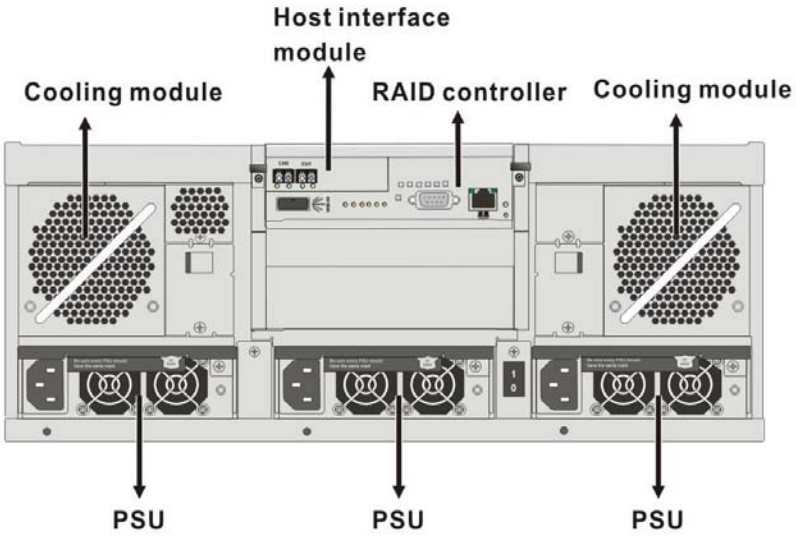


Figure 1-4: Falcon IV Rear View

The enclosure rear section accommodates the following components:

- **RAID controller module(s):** The RAID controller module manages all functionalities provided with the system, and all interface connectors are provided on the controller faceplates. (See **Section 1.2.3**)

- **CBM module:** CBM modules come as standard equipment for the redundant-controller R1840 model, and as an optional module for the single-controller G1840. The BBU within CBM sustains unfinished writes cached in memory and cached data will be transferred to a flash module during a power outage in order to protect data integrity. (See **Section 1.2.6**)

- **PSU modules:** The hot-swappable PSUs receive single-phase power and deliver +5V and +12 V power to system. A power switch is located on the rear panel to turn all PSU on and off. (See **Section 1.2.7**)

- **Cooling modules:** The redundant cooling modules ventilate the system to maintain a cooling airflow across the system. (See **Section 1.2.8**)

1.1.2.6 Backplane Board

An internal backplane board separates the front and rear sections of the enclosure. The backplane consists of traces for logic level signals and low voltage power paths. It contains no user-serviceable components.

WARNING!

When inserting a removable module, **DO NOT USE EXCESSIVE FORCE**! Forcing or slamming a module can damage the pins on the module connectors either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more pressure to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

1.2 System Components

The Falcon IV is designed with modular components for ease of maintenance. Hot-swap mechanisms help prevent power surges and signal glitches that might occur while removing or installing these modules.

1.2.1 Drive Trays

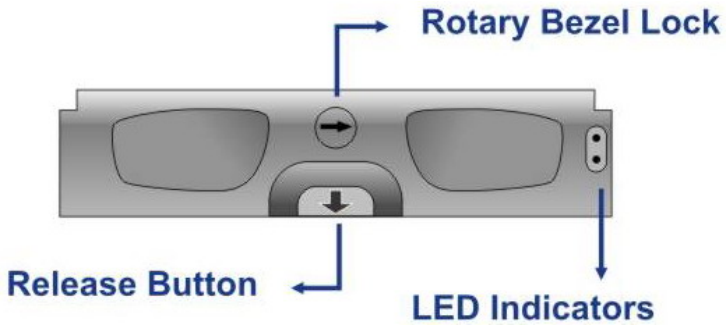


Figure 1-5: Drive Tray Front View

PN: IFT-9273CDTray

The drive trays accommodate separately purchased, standard 1-inch pitch, 3.5-inch, 3Gb/s, SAS or SATA-II disk drives. The drive bays are located in the front section of the chassis. Two (2) LEDs on the front bezel indicate the operating statuses of individual disk drives. A rotary bezel lock on the front bezel secures the hard drive in place, while a release button is used to open the front bezel.

WARNING!

Be careful not to warp, twist, or contort the drive tray in any way (e.g., by dropping it or resting heavy objects on it). If the drive bay superstructure is deformed or altered, the drive trays may not fit into

the drive bays.

1.2.2 MUX Kit

Unlike the dual-ported SAS drives, using the single-port SATA-II disk drives in a redun dant-controller system (Falcon IV) requires a MUX board.

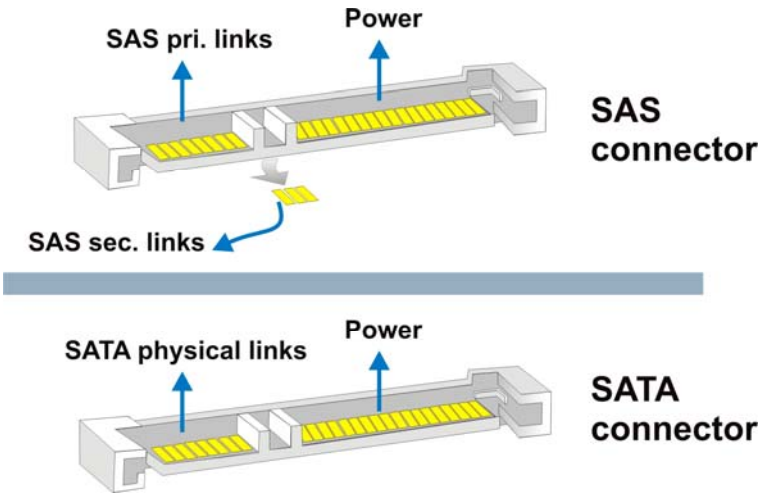


Figure 1-6: Comparison between Dual-ported SAS and Single-port SATA Connectors

The MUX bo ard p rovides port sel ector circuits for di recting acce ss from partn er RAID controllers to an individual di sk drive. See the drawing below for how it works.

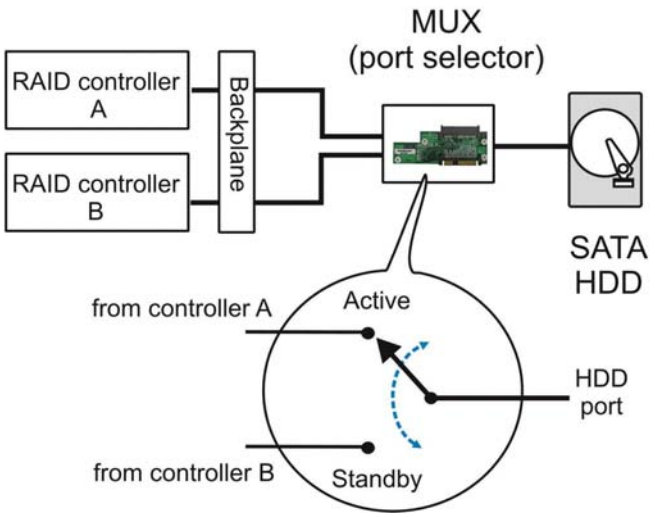


Figure 1-7: MUX Kit Working Theory

If SAS drives are preferred, thes e MUX boards will be unnecessary and must be manually removed from the drive trays by loosen ing retention screws from it.

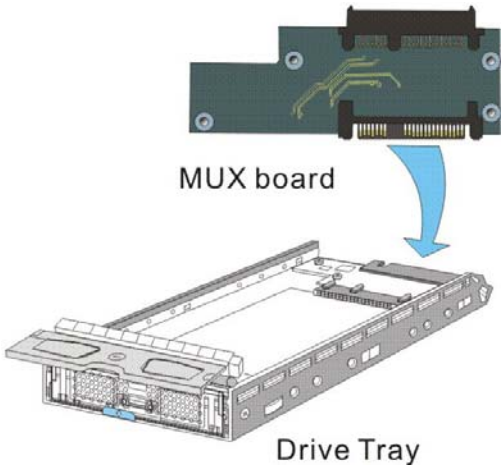


Figure 1-8: MUX Kit

1.2.3 The RAID Controller Module

PN:	Falcon x 2 (without cache memory)	Falcon IV
	Falcon (with 1GB cache)	
	Falcon x 1 (without cache memory)	Falcon IV
	Falcon x 1 (with 1GB cache)	

The default size for the DDR-II DIMM module on RAID controllers is 1GB. A RAID controller module contains a main circuit board, a preinstalled 1GB memory, battery charger circuitry, a daughter board with host port interfaces, and a flash module. The controller module contains no user-serviceable components. Except when servicing the cache memory or the CBM module inside, the controller module should never be removed or opened.

WARNING!

Although the RAID controller can be removed, the only time you should touch the controller itself is to install or replace the memory module and CBM. The RAID controller is built of sensitive components and unnecessary tampering can damage the controller.

The Falcon IV system is managed by the RAID controller(s). Each RAID controller comes with two (2) 8Gb/s FC host ports. Via FC switches, the system readily connect multiple application servers in a Fibre Channel Storage Area Network.

The docking connector at the rear of the controller board connects the controller to the backplane board.

1.2.4 Controller Module Interfaces

All external interfaces that connect to external devices are located on the controller module's rear-facing faceplate. The interfaces are listed below.

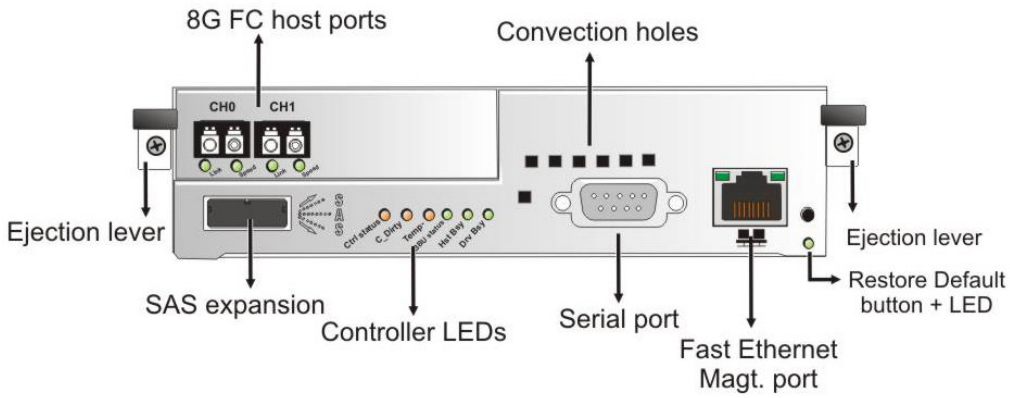


Figure 1-9: Controller Module Interfaces

- **Host ports:** Two (2) 8 Gb/s Fibre Channel host ports (indicated as CH0 and CH1 in the diagram shown above). These ports receive SFP transceivers and then attach to short-wavelength optical cables.

- **Serial port:** The controller module comes with one (1) COM ports. The serial port is used for local access to the firmware-embedded configuration utility using terminal emulation program.

- **LED indicators:** Six (6) LED indicators illustrate the system's key operating statuses. Please see **Chapter 4** for more information.

- **Ejection Levers:** Two (2) ejection levers on the sides of the controller ensure that the back-end connectors are properly seated in the module slot and properly mated with the backplane.

- **SAS Expansion Port**: The multi-lane expansion port connects to expansion enclosures (JBOD).

- **Management LAN Port:** An 10/100 BaseT Ethernet port connects the system to a network and then to a management computer. Available management interfaces include: telnet, Java-based SANWatch manager, or the web-based "Embedded RAIDWatch" manager invoked by an http console.

- **Restore Default LED and button:** The push button and LED are used to restore firmware defaults in case when upgrading firmware, upgrading DIMM size, or if an

administrator forgets system password. For more details, please refer to **Chapter 4**.

1.2.5 Cache Module

The controller default for the cache module is a 1GB DDR-II module and the allocable size up to 2GB. The memory socket is located on the side of the controller board.

1.2.6 CBM (Cache Backup Module)

PN: IFT-9373CBBU (CBM: IFT-9373CCBM, including flash module, a charger board, and BBU)

A Li-Ion battery backup unit (BBU) module (see the diagram below) can support the transfer of cached data from cache memory to an onboard flash during a power outage. The battery module comes with an EEPROM that marks the installation date, and system administrators will be notified when the 3-year life expectancy is reached. The BBU is contained within controller canister and is not hot-swappable.

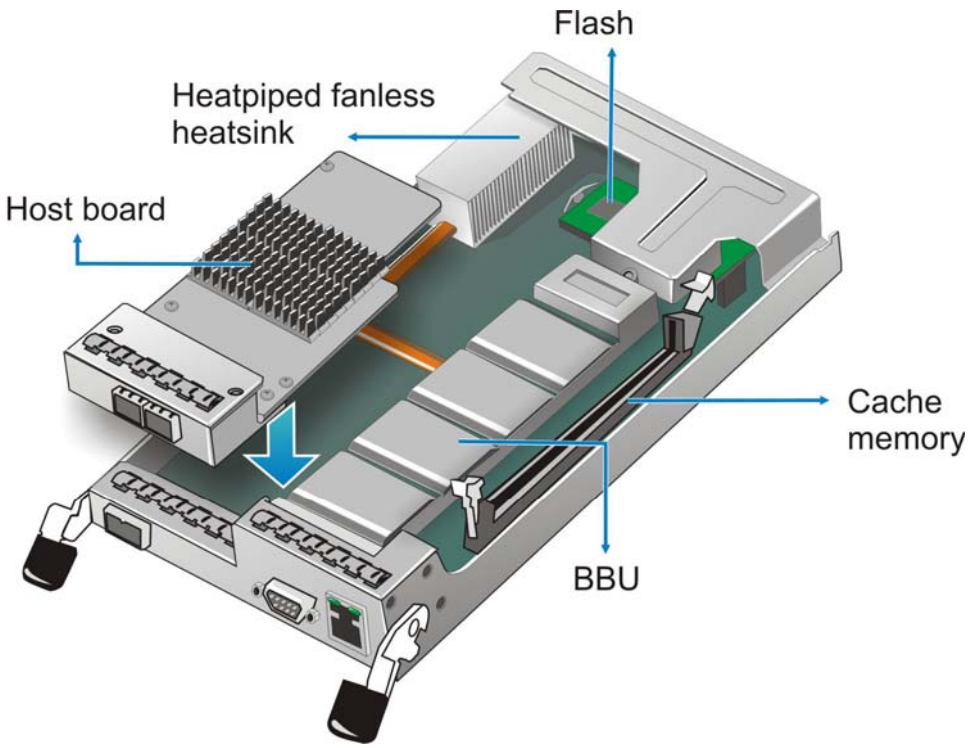


Figure 1-10: Modules within a Controller Canister

In accordance with international transportation regulations, the BBU module is only charged to between 35% and 45% of its total capacity when shipped. Therefore, when powering on the system for the first time, the BBU will begin to charge its batteries to its full capacity. It normally requires approximately twelve (12) hours for the battery to be fully charged. If the battery is not fully charged after twelve (12)

hours, there may be a problem with the BBU module. You may re-install the battery; and if the battery still shows problems with charging, contact your system vendor for a replacement. While the battery is being charged, a system event will prompt.

You can check battery's charge level using a terminal console with firmware's embedded utility.

1.2.7 Power Supply Units

PN: IFT-9274CPSU

The system is equipped with three (3) redundant, hot-swappable, load-sharing 405W PSUs, at the rear section of the chassis. The PSU is housed in a 1U canister containing both the power supply and dedicated cooling modules.

A single LED indicates the PSU status. When a power supply failure occurs, the LED lights red. An extraction handle at the rear of the PSU is designed to help properly install or remove the module.

A screw hole on the extraction handle helps secure the PSU to the chassis. The shipping package contains adjustable cable clamps that can be used to secure power cord connections.

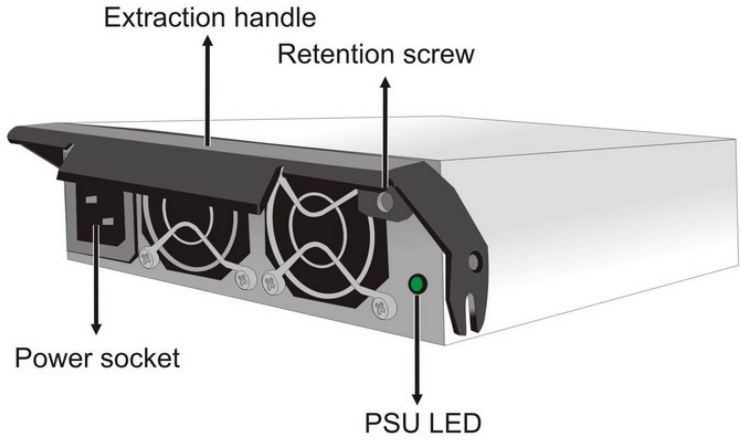


Figure 1-11: PSU Module

Please refer to **Appendix A** for the technical information of the PSUs.

1.2.8 Cooling Modules

PN: IFT-9374CFANMOD

Two cooling modules at the rear center ventilate the system. (see **Figure 1-12**.) The cooling fans operate at two (2) fan speeds. When the system operates normally, the cooling fans operate at the lower speed. If a system module fails or when one of the temperature

thresholds is violated, the cooling fans automatically raise its rotation speed.

More technical information can be found in **Appendix A**.

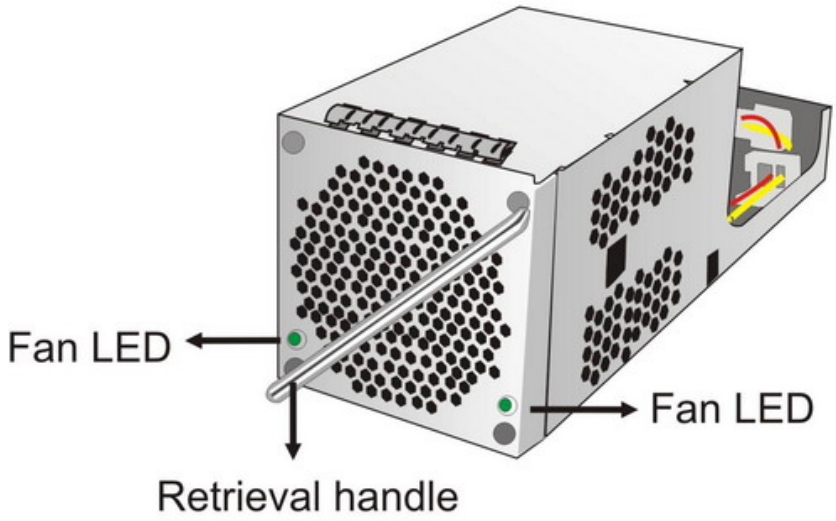


Figure 1-12: Cooling Module

1.3 System Monitoring

The system comes with a number of different monitoring methods that provide you with continual updates on the operating statuses of the system and individual components. The following monitoring features are included:

1.3.1 I²C bus

The following system elements are interfaced to the RAID controller over a non-user-serviceable I²C bus:

- Power supplies and cooling modules
- Module presence detection circuits
- Temperature sensors (for detecting the temperature on the backplane board and controller board)

1.3.2 LED Indicators

The following components come with LEDs to indicate the operating statuses of individual components:

- LCD keypad panel
- RAID controller

- Cooling modules (2 LEDs on a PSU faceplates)
- PSU modules (1 LED on each module)
- Drive trays (2 LEDs on each tray)

1.3.3 Audible Alarm

The system comes with an audible alarm that is triggered when a component fails or when the pre-configured temperature or voltage thresholds are exceeded. Whenever you hear an audible alarm, it is imperative that you determine the cause and rectify the problem immediately.

Event notification messages indicate the completion configuration tasks, status of components, or fatal errors. Events are always accompanied by two (2) or three (3) successive and prolonged beeps.

WARNING!

When an audible alarm is heard, system administrators should rectify the cause of the alarm as soon as possible.

1.4 Hot-swappable Components

1.4.1 Hot-swap Capabilities

The system comes with a number of hot-swappable components. A hot-swap component is one that can be exchanged while the system is still operating. These components should only be removed from the chassis when they are being replaced. At no other time should these components be removed from the system.

1.4.2 Components

The following components are hot-swappable:

- RAID controller (in a redundant-controller configuration)
- Power supply units (PSUs)
- Cooling modules
- Hard disk drives

1.4.3 Normalized Airflow

Proper cooling is referred to as “normalized” airflow. Normalized airflow ensures the sufficient cooling within the system and is only attained when all components are properly installed. Therefore, a failed component should only be removed when a replacement is available. If a failed component is removed but not replaced, airflow will be disrupted and damage to the system can result.

Chapter 2

Hardware Installation

2.1 Introduction

This chapter provides detailed instructions on how to install the system. Installation into a rack or cabinet should occur **before** the hard drives or drive trays are installed into the system. Please confirm that you received all of the components listed on the included **Unpacking List** before proceeding with the installation process.

2.2 Installation Prerequisites

1. **Static-free installation environment:** The Falcon IV system must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage. (See **Section 2.3.2**)

2. **Component check:** Before installing the Falcon IV system, you should first check to see that you have received all the required components. (See **Section 2.5**) If any items appear damaged, contact your vendor for a replacement.

3. **Hard drives:** Hard drives are separately purchased. Please consult RAID, Inc's VIP room service site or technical support for the latest list of compatible hard drives. (See **Section 2.7**)

NOTE:

If SATA drives are preferred, currently only 3Gbps SATA-II disk drives are supported. Make sure you properly configure HDD configuration (such as jumper setting) before you install hard drives into the system. Some hard drives come with a default speed set to 1.5Gbps.

If using hard disks defaulted to 1.5Gbps, compatibility issue may occur.

4. **Cabling:**

   The system comes with the following cables;

   1. Three (3) **power cords** for connections to the power sources. Cable type is determined by the shipped-to area.

   Other cables are user-supplied:

   1. **Host link cables**: Use 8G or 4G FC transceivers (An Avago's transceiver and optical cables are included as RAID, Inc's accessories) and LC type, short-wavelength optical fiber cables to connect the host ports. With 8G speed, you need better quality cables to maintain the same cabling distance. See **Chapter 3** for cabling topologies.
   2. A DB-9 Y-cable for connecting the serial port to a terminal station (dual-controller Falcon IV only).
   3. One (1) or two (2) Ethernet cables to the 10/100BasetT **management port**.

5. Mixing SAS and SATA drives in the same enclosure is allowed. However, please DO NOT mix SAS and SATA-II drives in the same drive column. Vibration from high rotation speed drives will affect adjacent drives that are seeking data tracks.

   DO NOT place a column of SATA-II disk drives between two columns of SAS disk drives. With a higher rotation speed, the SAS disk drives on the flanks of SATA-II disk drives will eventually cause a stability issue.

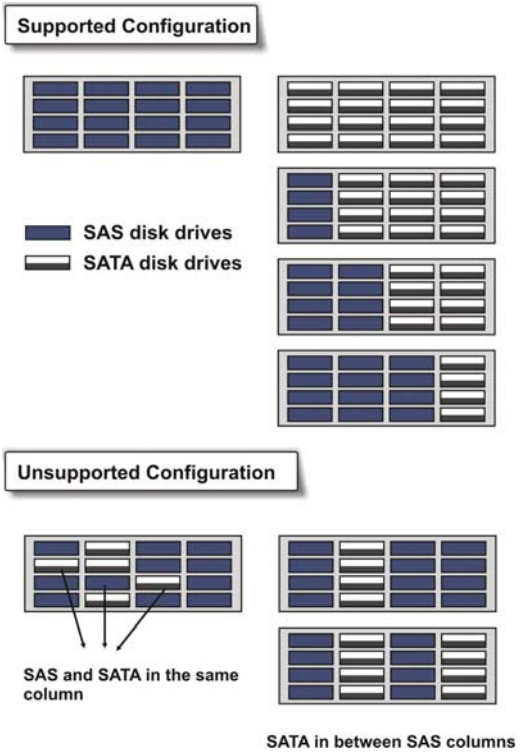


Figure 2-1: Supported and Unsupported Drive Configurations

2.3 Safety Precautions

2.3.1 Precautions and Instructions

1. **Static-free installation environment:** The enclosure must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage.

2. **Component check:** Before installing the enclosure, check to see that you have received all the required components. If any items appear damaged, contact your vendor for a replacement.

3. **Rack installation:** The enclosure chassis can be installed into a rack cabinet using rackmount rails from RAID, Inc or those that are separately purchased. Rack-mounting details will be discussed later.

4. Disconnect the power cords if the need should arise for cleaning the chassis. Do not use liquid or sprayed detergent for cleaning. Use a lightly moistened clothe for cleaning.

5. Be sure the correct power range (100-120 or 220-240VAC) is supplied by the power source at your installation site. It is highly

recommended to connect two different power supplies to separate power sources; e.g., one to a power outlet, and the other to a UPS system.

6. Thermal notice: All drive trays (even if they do not contain a hard drive) must be installed into the enclosure. Leaving a drive bay or module slot open will severely affect the airflow efficiency within the enclosure, and will consequently lead to system overheating. Keep a faulty module in place until you have a replacement unit and you are ready to replace it.

7. Rack-mounting: The system is intended to be rack-mounted. Following concerns should be heeded when mounting the enclosure into a rack cabinet:

   a. An enclosure without disk drives can weigh over 30 kilograms. Two (2) people are required to install or relocate the system. Drives should be removed from the enclosure before moving the system.

   b. The system is designed to operate in an environment where the ambient temperature around the chassis must not exceed 35°C.

   c. The openings on the enclosure are for air circulation and hence the ventilation openings should never be obstructed.

   d. Proper grounding, over-current protection, and stability features should be provided with the rack cabinet into which the system is mounted.

8. Operate the system in an environment with least humidity.

9. Lay the system on a reliable surface when servicing individual modules. A drop or fall can cause injury.

10. Make sure the voltage of the power source is within the rated values before connecting the system to the power source. You may also refer to **Appendix A** of this manual for technical details.

11. Airflow considerations: The system requires an airflow clearance especially on the front and the rear sides. For proper ventilation, a minimum of 2.5cm is required between the front of the enclosure and rack cover; a minimum of **18 to 20cm** is required on the rear side.

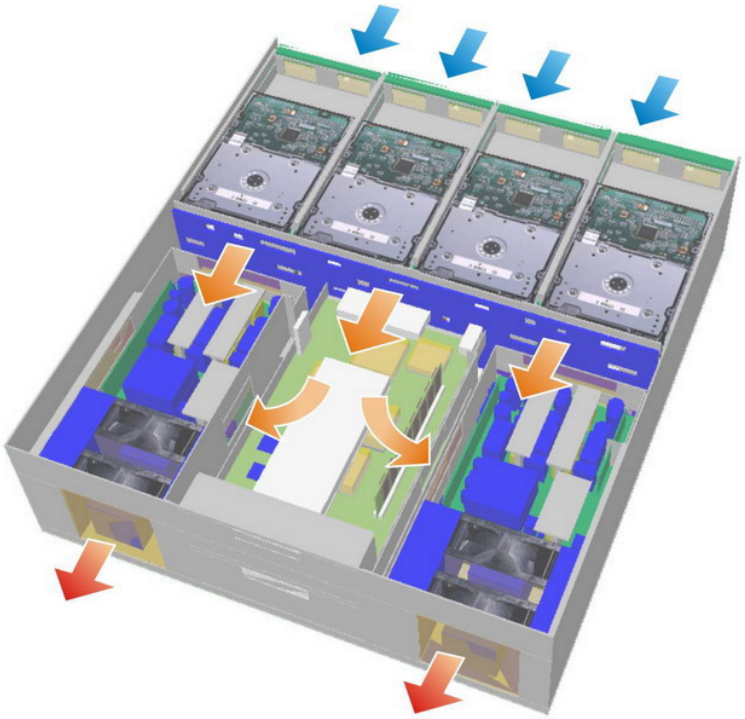


Figure 2-2: Airflow Direction

12. Do not cove r the convecti on holes on cont roller faceplate. They provide passages for air circulation, and also a glimpse of the 7-seg LED for debug purposes.

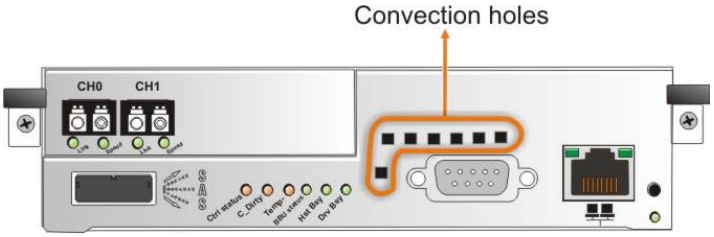


Figure 2-3: Controller Convection Holes

13. Handle the system mod ules by the re tention scre ws, ej ection levers, or the module s' metal frame s/faceplates only. Avoid touching the PCB boards and connector pins.

14. None of the covers or replaceable modules should be removed in order to maintain com pliance with safety, emission , or thermal requirements.

15. If the system is going to be left u nused for a long time, disconnect the system from mains to avoid damages by transient over-voltage.

16. Never pour any liquid into ventilation op enings; this could cau se fire or electrical shock.

17. Never open the system top cover. For safety reasons, only qualified service personnel could access the interior of the chassis.

18. Always secure every enclosure module by its retaining screws or make sure it is held in place by its latches or hand screws.

19. Always make sure the system has a safe electrical earth connection via power cords to the power source sockets at the installation site.

20. Be sure that the rack cabinet in which the system chassis is to be installed provides sufficient ventilation channels and airflow circulation around the chassis.

21. Provide a soft, clean surface to place your enclosure on before working on it. Servicing the enclosure on a rough surface may damage the finish of the chassis.

22. If it is necessary to transport the system, repackage all disk drives separately.

23. If one of the following situations arises, get the enclosure checked by service personnel:

    a. Any of the power cords or plugs is damaged.

    b. Liquid has penetrated into the system.

    c. The enclosure has been exposed to moisture.

    d. The system does not work well or you cannot get it work according to this manual.

    e. The system has dropped and been damaged.

    f. The system shows obvious signs of breakage.

2.3.2 Static-free Installation

Static electricity can damage the system's electronic components. To prevent ESD damage to any of the components, follow these precautions before touching or handling them:

- Discharge the static electricity accumulated in your body by wearing an anti-static wristband.
- Use antistatic strap during handling. Connect the equipment end of the strap to an unfinished chassis surface.
- Avoid carpets, plastic, vinyl, and styrofoam in your work area.

- If the need should arise for carrying system modules from one place to another, carry them in a static shielding container.
- Avoid the contact between circuit boards and clothing.
- Handle all components by holding their edges or metal frames. Avoid touching the exposed circuitry on PCB boards and connector pins.

2.4 General Procedure

Step 1. **Unpack:** Unpack the system and confirm that all the components on the **Unpacking Checklist** have been included.

Step 3. **Rack/Cabinet installation:** Installing the system into a rack or cabinet requires at least two (2) people. (See **Section 2.6**)

Step 4. **Install hard drives:** Secure SAS/SATA-II hard drives within the drive trays. (See **Section 2.7**)

Step 5. **Install drive trays:** After the hard drives have been secured in the drive trays, install drive trays into the enclosure. (See **Section 2.9**)

Step 6. **Cable connection:** Connect power cords, FC host links, serial port, and Ethernet cables.

Step 7. **Power up:** Once the components have been properly installed and all cables are properly connected, you can power up the system and configure the RAID array.

Installation Procedure Flowchart

Figure 2-4 shows a flowchart of the installation procedure. As you complete each step, check off the "**Done**" box on the right. Please use this flowchart in conjunction with the instructions that follow.

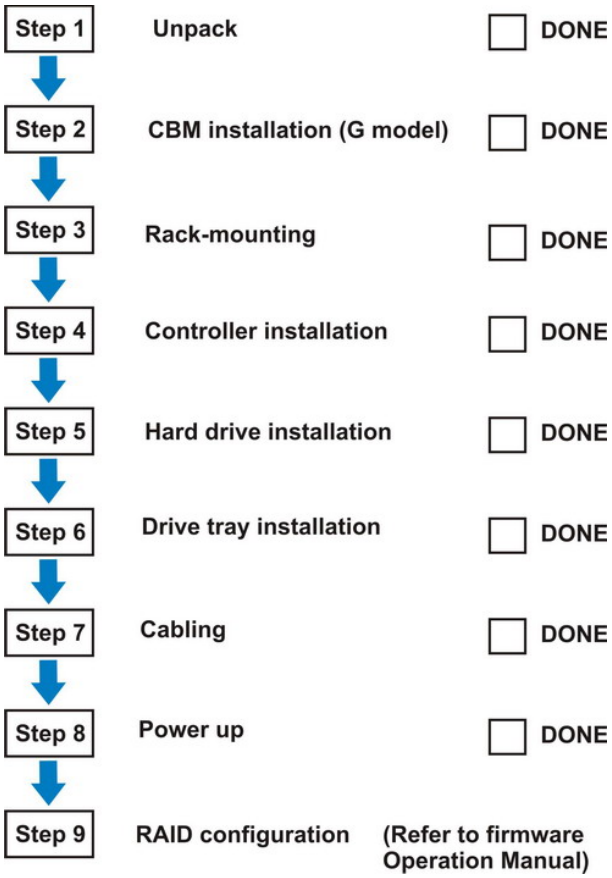


Figure 2-4: Installation Procedure Flowchart

2.5 Unpacking the System

Use the **Unpacking Checklist** in your package to verify package contents. Carefully check the items contained in each box before proceeding with installation.

NOTE:

A detailed unpacking list can be found in your product shipping package or product CD.

The package contents are shown below:

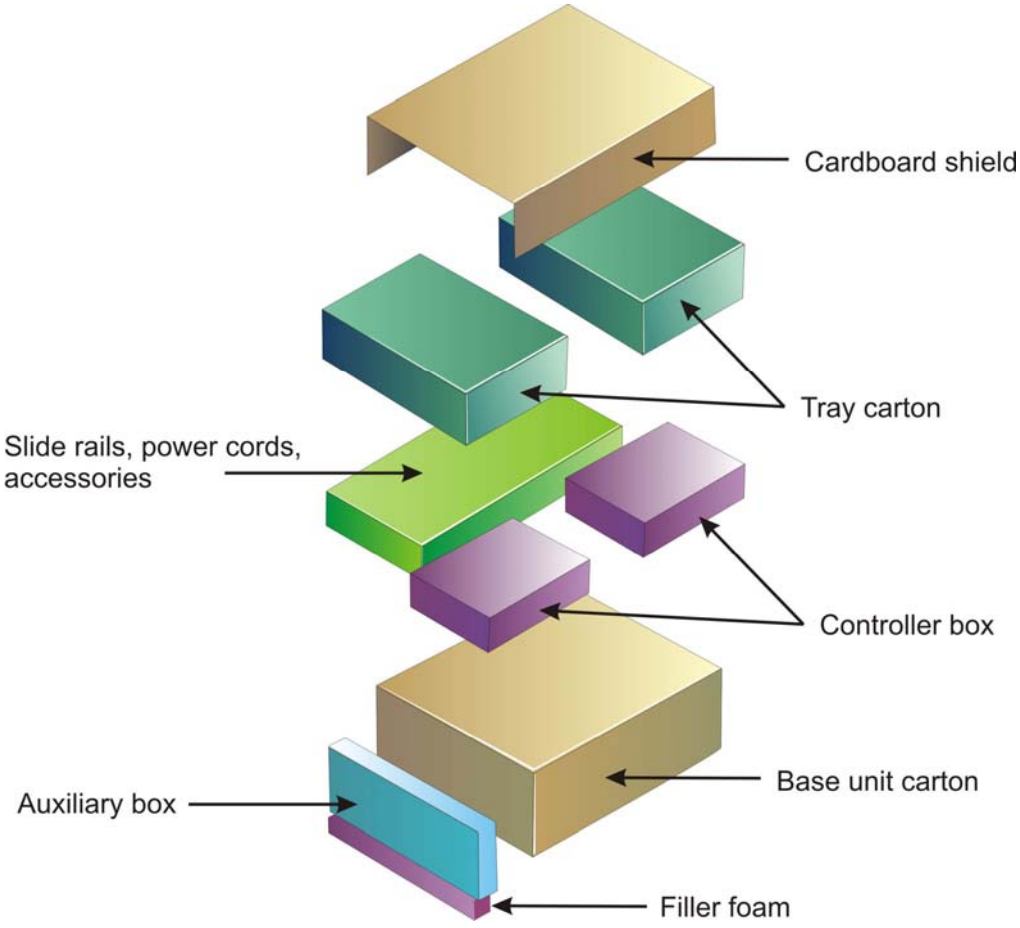


Figure 2-5: System Package

1. Three power cords.
2. A printed copy of **Quick Installation Guide**.
3. Screws for rack-mounting and securing disk drives.
4. A product utility CD containing the **Installation and Hardware Reference Manual** (this document), the **Operation Manual** (firmware), the SANWatch programs and **SANWatch User's Manual**, and other related documentation.

5. If ordered, rackmount rails will be included.
6. If additional power cords or host links cables have been included in a placed order, they will be shipped in the auxiliary box.

2.5.1 Preinstalled Components

The following components have been installed at the factory and do not need to be installed:

- 1 - Backplane board
- 1 - DDR-II DIMM module (in each controller module)
- 3 - PSU modules
- 2 - CBM modules (redundant-controller model)
- 1 - LCD keypad panel
- 2 - Cooling fan modules

2.5.2 Components to be Installed

You must install the following components:

- Rackmount rails (standard for the dual-controller Falcon IV)
- RAID controllers
- CBM module (for the single-controller Falcon IV)
- Hard drives (separately purchased SAS or SATA-II disk drives)
- Drive trays
- Cables

2.6 Rack/Cabinet Installation

PN: IFT-9373CSlide36 - for 24" to 36" deep rack

The system is designed to fit into a variety of 19-inch rack cabinets or racks. Make sure you have an appropriate site location and cables prepared with adequate lengths to connect to power source and other devices.

When installing the system into a rack or cabinet it is advisable that two (2) people assist in the mounting process.

Package Contents

The rackmount rail kit should include the following components:

Item	Description	Quantity
01	Mounting bracket assembly, L-shape, left-side	1
02	Mounting bracket assembly, L-shape, right-side	1
03	Inner glide	2
04	Flange filler plate (fixed behind chassis ears)	2
05	Cross recess truss head screws M5 x 9.0mm	8
06	#6-32 x10mm flathead screws	4
07	#6-32 L6 flathead screws	6
08	M5 cage nuts	4

NOTE:

Screws for securing chassis to the front rack posts are provided in the system's **accessory box**. There are 4 M5 x35mm, 4 M6 x35mm, and 4 #10-32 31.75mm screws.

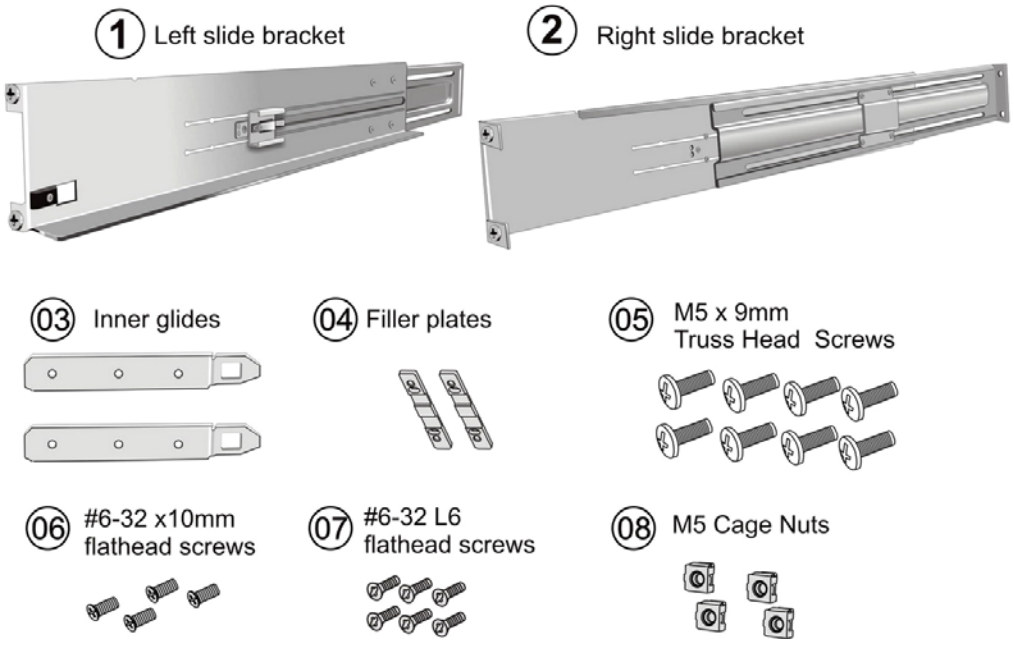


Figure 2-6: Rackmount Rail Components

Installation Pre-requisites

- 1 medium-size and 1 small-size cross-head screwdrivers
- 1 medium-size flat-head screwdriver
- Because the RAID system can weigh over 28 kilograms, 2 people are required to rack-mount the enclosure.

CAUTION!

The hard drives and drive trays should only be installed into the system after the system has been mounted into a rack cabinet. If the hard drives are installed first, the system will be too heavy to handle and the possible impact during installation may damage your drives.

Rack-mounting Steps

Step 1. Determine where in the rack, the system is going to be installed by referring to the rack post drawing below.

CAUTION!

The mounting positions must be carefully measures so that rails can be mounted parallel to each other.

Step 2. Use the figures below to measure the relative locations of the cage nuts on the rack posts (if they do not have threaded holes). Attach two M5 cage nuts (#08) on each of the front rack posts.

On Front Rack Posts:

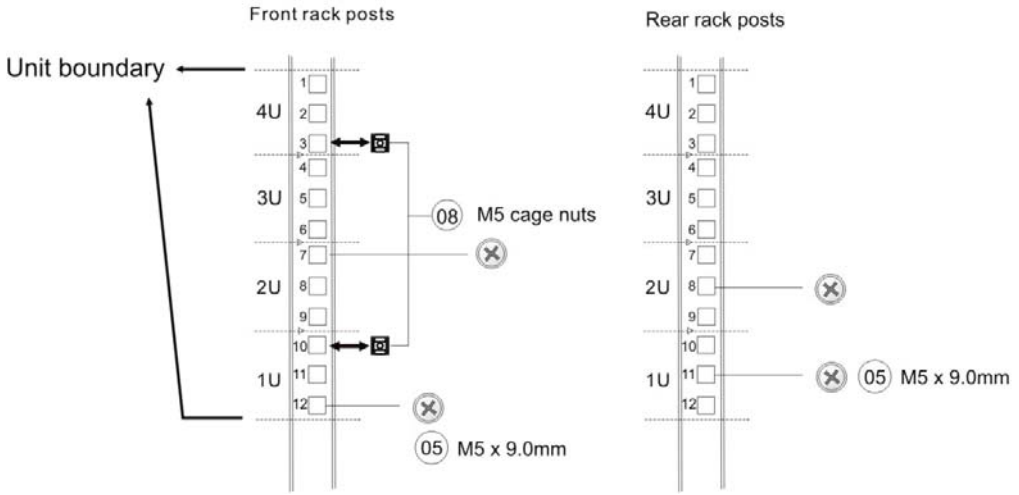


Figure 2-7: Rack-mount Position & Cage Nut Positions on Rack Posts

Step 3. Attach inner glides to the sides of chassis using the included screws.

When attaching the inner glides, orient them so that the slimmer part of the glides has a bend towards the center of chassis. If installed in a wrong orientation, you will not be able to install the chassis into rack.

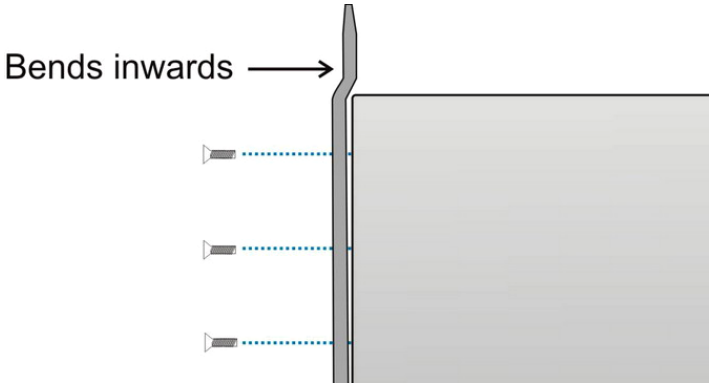


Figure 2-8: Inner Glide Orientation: Top View

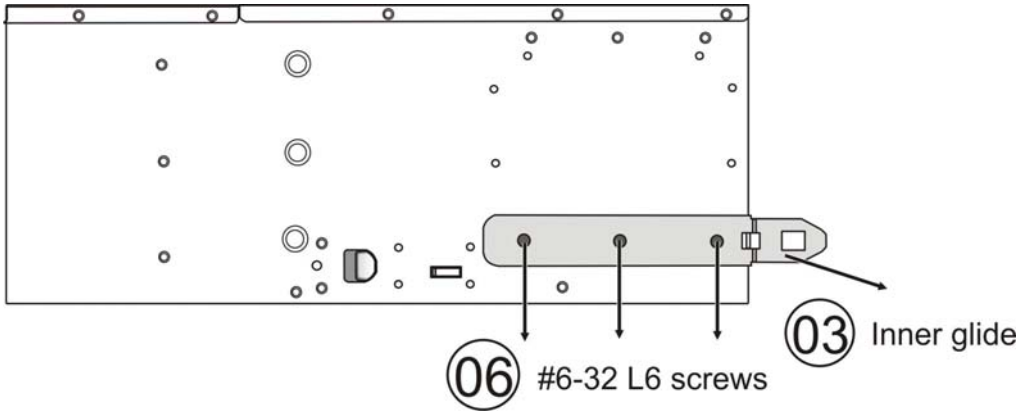


Figure 2-9: Attaching an Inner Glide

Step 4. Adjust the length of the rail assembly and make sure the bend of the L-shape rail (#01) faces inward. Loosen the four screws near the end of the L-shape bracket to adjust rail length. Fasten them when length adjustment is done.

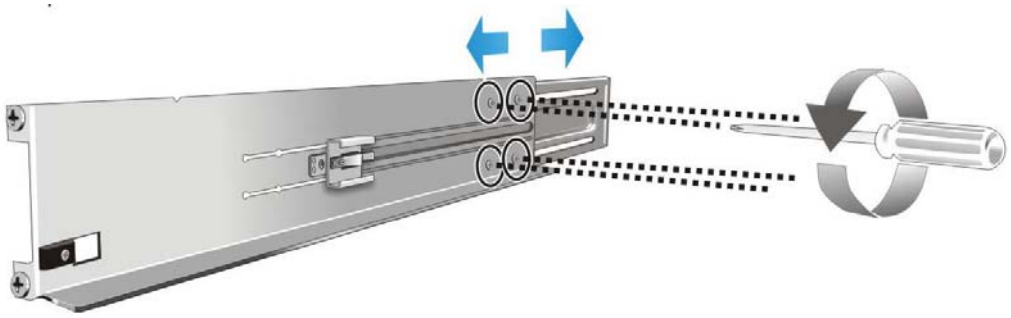


Figure 2-10: Adjust the Rail Length

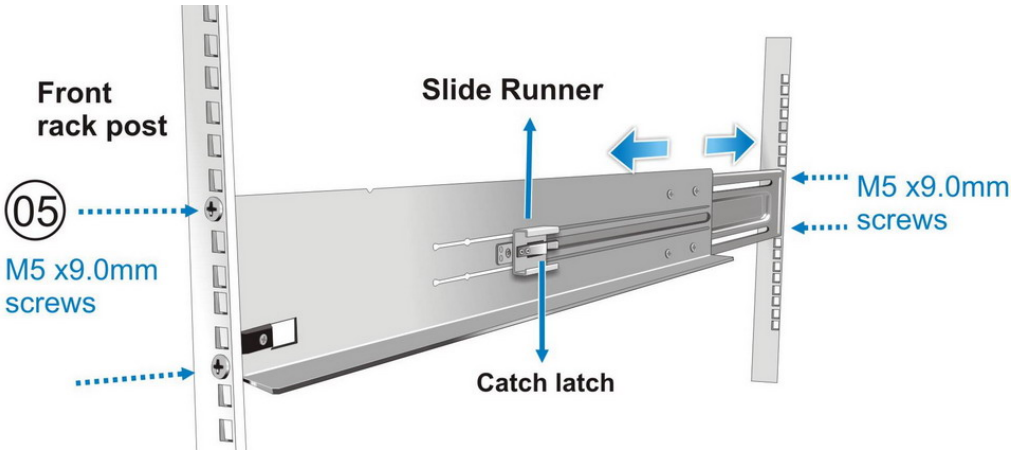


Figure 2-11: Fitting the Rail into Rack

Step 5. Secure the rail to the front and rear rack posts each using two M5 screws (#05). (See figure above) Do not insert the screws into the cage nuts as cage nuts will be used to secure the enclosure later.

Step 6. Attach the filler plates (#04) behind the enclosure ears using the four #6-32 x 10mm flat head screws (#06) on each side.

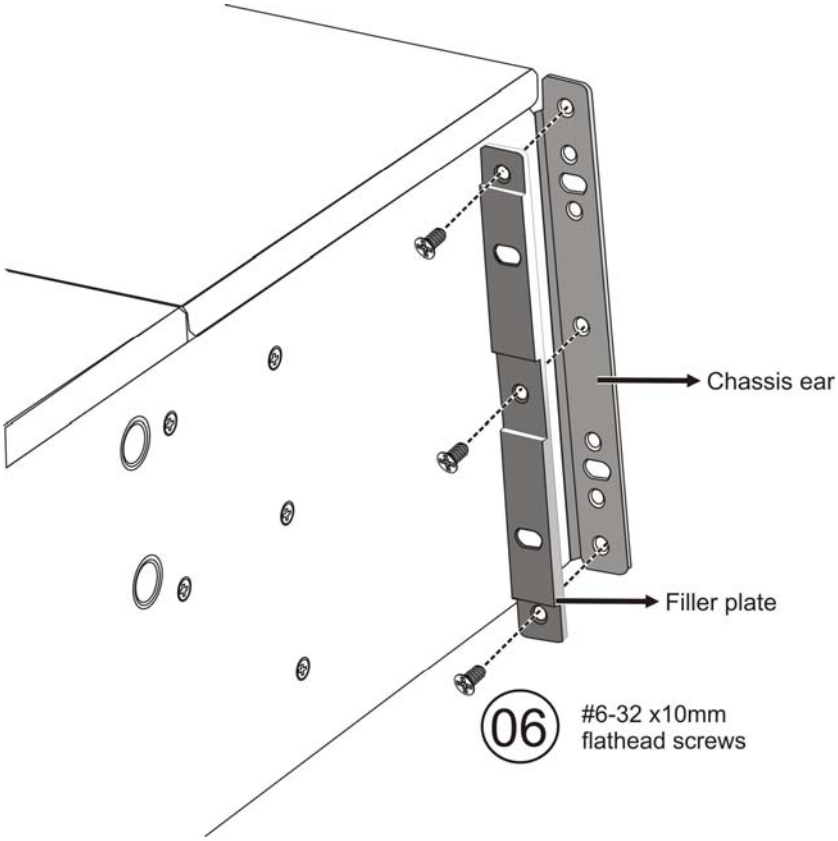


Figure 2-12: Securing a Filler Plate behind Chassis Ears

Step 7. Place the enclosures on to the rails and slide the enclosure into rack until its chassis ears flush with the front rack posts. Two people are required.

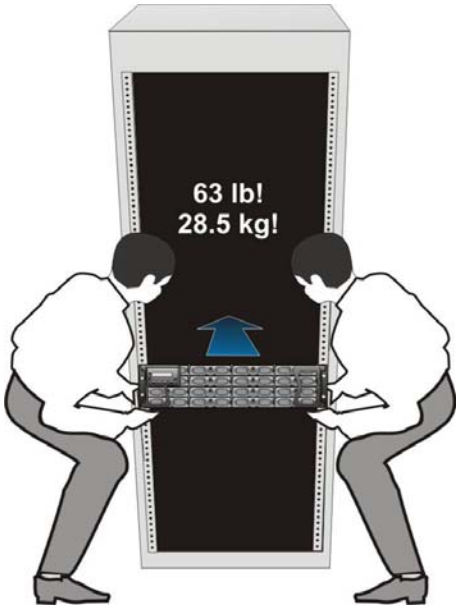


Figure 2-13: Mounting the Enclosure

While pushing the chassis into rack, make sure the tips of inner glides fit into the U-shape brackets on the slide runners. A “click” sound will be heard when the inner glides catch the spring latches on the slide runners.

Step 8. Fasten four screws provided in your accessory box (M5, M6, or #10-32) through the holes on the forearm handles.

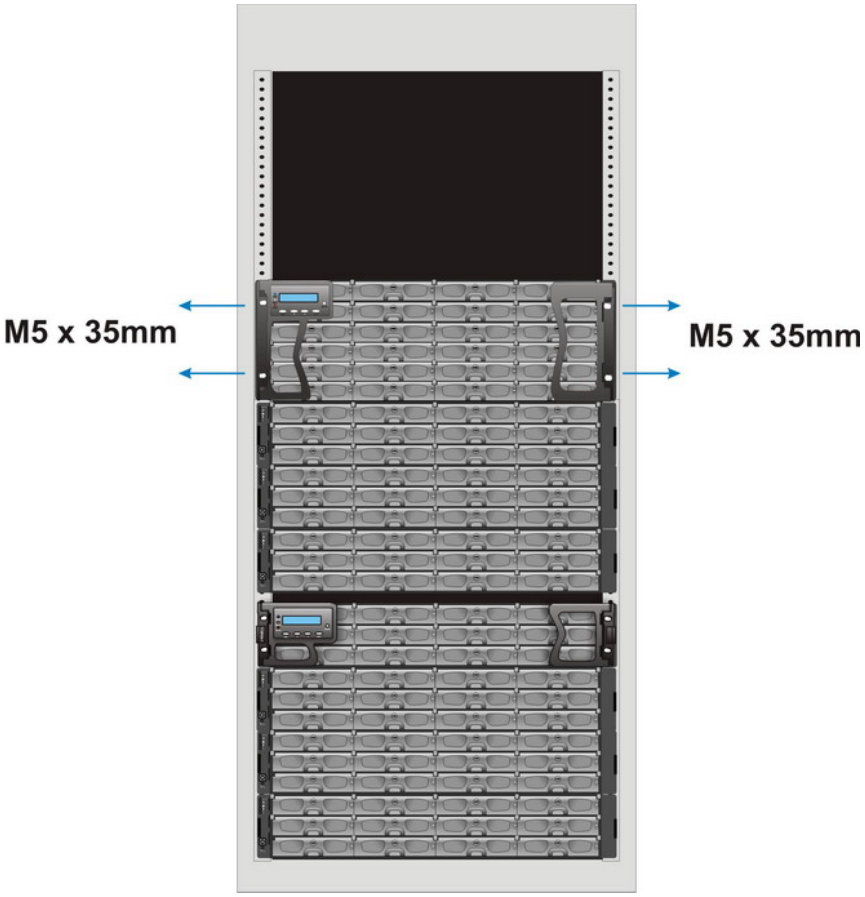


Figure 2-14: Securing Enclosure to Rack

Removing Chassis

If you need to remove a chassis from rack:

Step 1. Remove disk drives from chassis.

Step 2. Remove the screws fastened through the chassis ears.

Step 3. Pull the chassis out until it is stopped by the retention latches.

Step 4. Use both hands to support the weight of the chassis, and then use your index fingers to press and pull the release latches towards you.

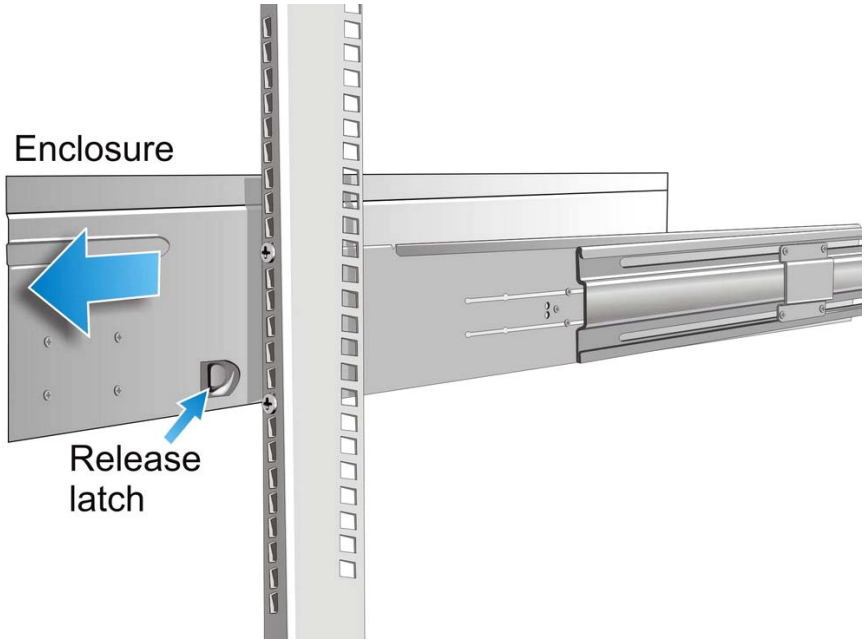


Figure 2-15: Removing Chassis from Rack

Step 5. When the chassis is released, slowly pull the chassis from rack. Another person should be helping you to remove chassis from rack.

2.7 Controller Installation

2.7.1 Installing a Controller Module

NOTE:

If you have a separately purchased CBM, install it before you install the controllers.

Step 1. **Wear an anti-static wrist strap.** When handling the controller, avoid touching circuit boards and connector pins.

Step 2. **Remove controllers from the controller boxes.**

Step 3. Align the controller module with the controller module bay, making sure that the levers are down. Gently slide the controller module in.

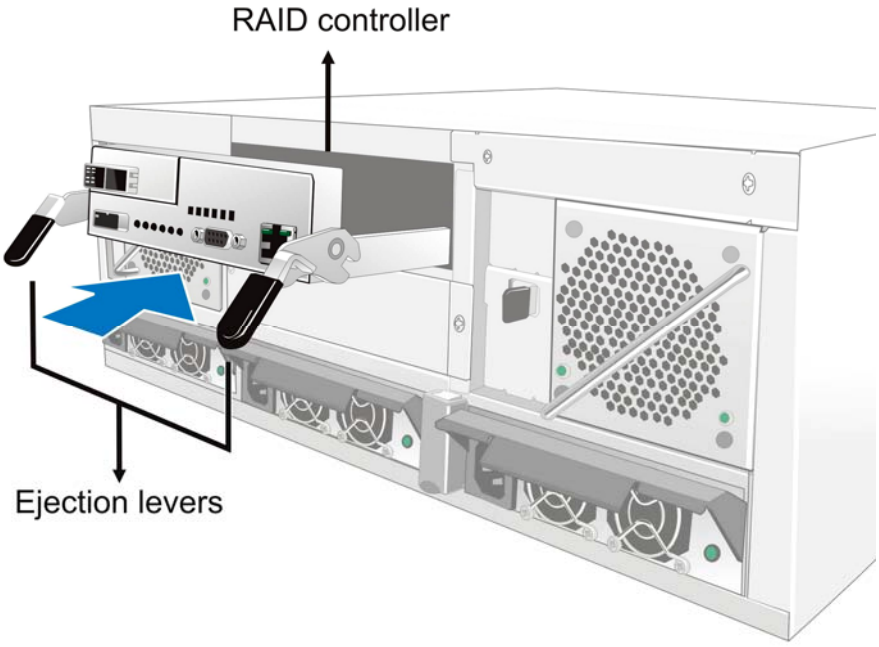


Figure 2-16: Inserting a Controller into Chassis

Step 4. **Secure the connection.** When the controller is reaching the end and you feel the contact resistance, use slightly more force to mate the controller with backplane connectors. When the controller is almost fully inserted, use the ejection levers to secure the controller. The levers help ensure that the back-end connectors are properly mated.

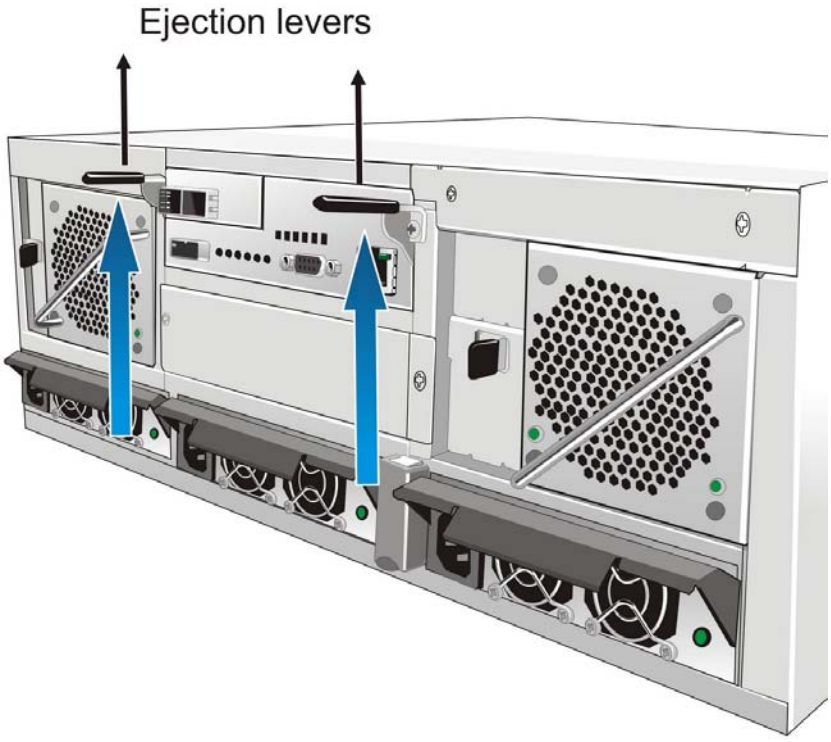


Figure 2-17: Using Ejection Levers to Secure Controller

Step 5. **Fasten the retention screws**. Once fully inserted, secure the controlle r module to the cha ssis by fastening the retention screws thro ugh the holes underneath the ejection lever.

Step 6. **Continue with installing cabling and other components.**

2.8 Hard Drive Installation

2.8.1 Hard Drive Installation Prerequisites

Hard drives are separately purchased. Before installing hard drives, the following factors should be considered:

Capacity (MB/GB): Use drives with the same capacity. RAID arrays use a "least-common-denominator" approach. The maximum capacity allocated from each disk drive is the maximum capacity that can be leveraged from the smallest drive. Choose big drives with the same storage capacity.

Profile: The drive trays are designed for 3.5-inch-wide x 1-inch-high hard drives.

Drive type: This model accommodates SAS or SATA-II (3Gbps) hard drives.

MUX Board: MUX boards are required if using SATA drives in a redundant-controller configuration both in RAID and the expansion enclosures. The Falcon IV comes with MUX boards in its drive trays.

WARNING!

1. Handle hard drives with extreme care. Hard drives are very delicate. Dropping a drive against a hard surface (even from a short distance) and hitting or touching the circuit board on the drives with your tools may cause damage to the drives.
2. Observe all ESD prevention methods when installing drives.
3. Only use screws supplied with the drive canisters. Longer screws can damage the hard drives.

2.8.2 Drive Installation

Step 1. **Place the hard drive into the drive tray** (as shown below), making sure that the interface connector is facing the open side of the drive tray, and the label side facing up.

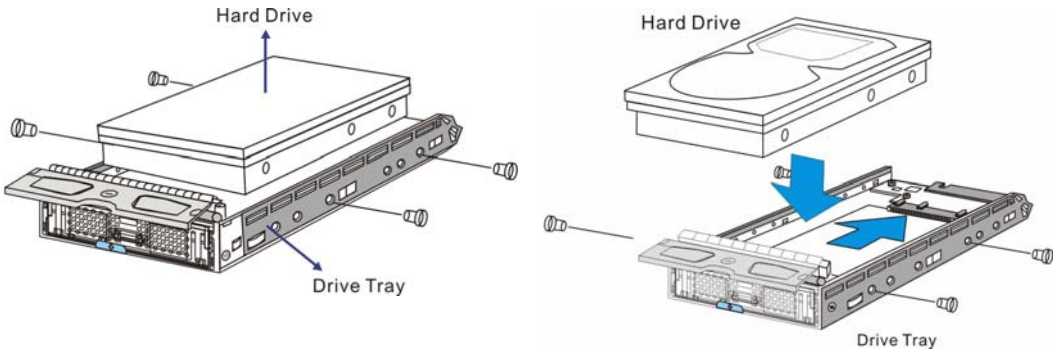


Figure 2-18: Installing a Hard Drive

Step 2. **Adjust the drive's location** until the mounting holes in the drive canister are aligned with those on the hard drive. Screws holes used for the installation with or without a MUX board are different.

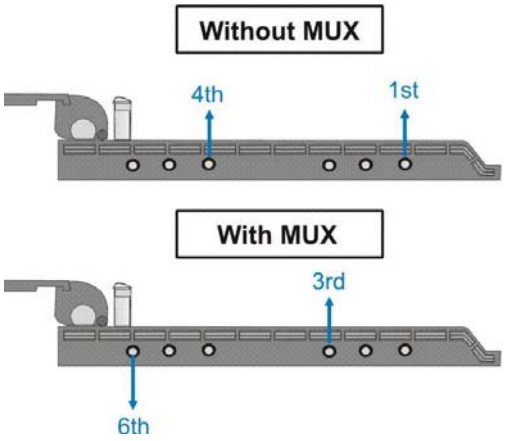


Figure 2-19: Drive Locations with and without the MUX Board

Step 3. Secure the disk drive with four (4) of the supplied 6/32 flat-head screws.

Step 4. Once the hard drives are installed into drive trays, install all drive trays into the enclosure. See detailed instructions in the following section.

2.9 Drive Tray Installation

Once the hard drives have been secured within the drive trays, the drive trays can be installed into the system.

WARNING!

All drive trays must be installed into the enclosure even if they do not contain a hard drive. If there are empty drive bays, the ventilation airflow will be disrupted and the system will overheat.

Step 1. Use a small-size (1/8") flat-blade screwdriver to turn **the rotary bezel lock to the unlocked position**, i.e., the groove on its face is in a horizontal orientation.

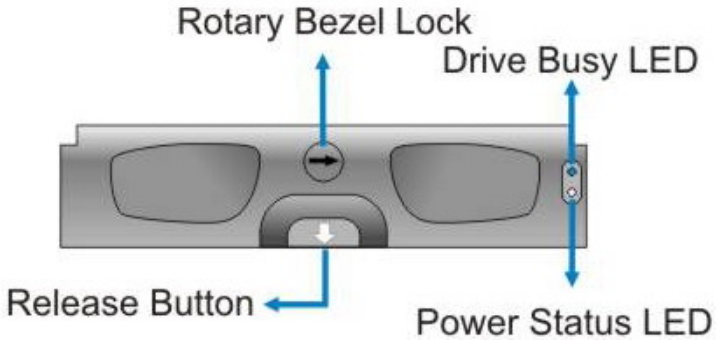


Figure 2-20: Drive Tray Front Bezel

Step 2. **Open the front bezel on the drive tray.** Push the release button on the drive tray. The front bezel will spring open.

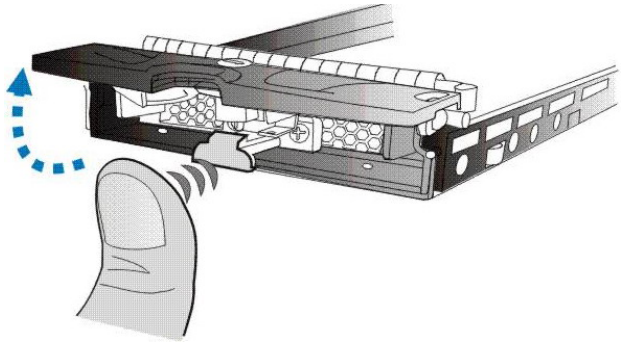


Figure 2-21: Drive Tray Release Button

Step 3. **Align the drive tray with a drive bay**. Gently slide it in until the drive tray reac h the end of drive bay. Thi s should be done smoothly and gently.

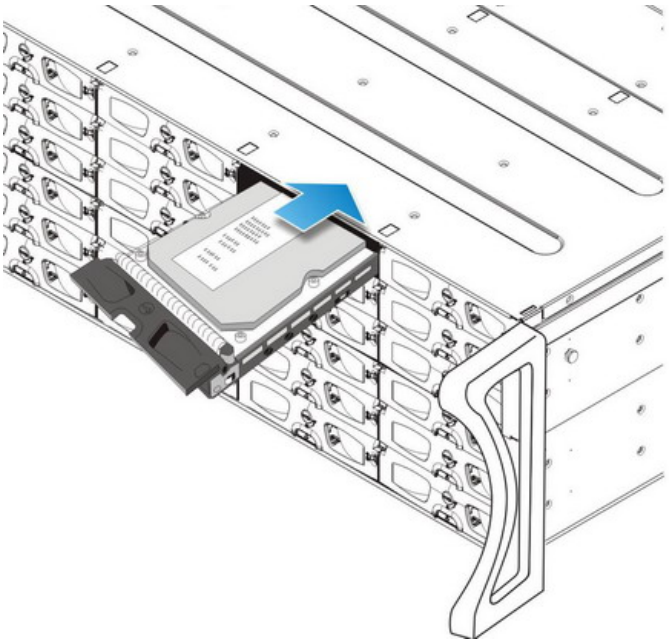


Figure 2-22: Installing a Drive Tray

Step 4. **Close the front bezel**. Make sure the front bezel is closed pr operly to e nsure th at th e b ack-end connector is pro perly mated with the co rresponding connector on the backplane. If the front bezel can n ot closed prope rly, the connection bet ween the hard drive an d the syste m may com e loose an d mysterious drive signals may result.

Step 5. **Lock the bezel into place** by turnin g the key-lo ck until the groo ve on its face is pointing down (verti cal orientation).

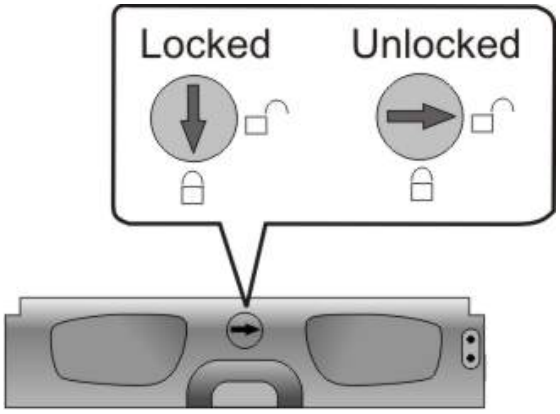


Figure 2-23: Front Bezel Rotary Lock

Step 6. Once the drive bays are populated and the system powered on, the RAID controller will automatically spin up the hard drives and recognize their presence.

2.10 Installing CBM (Optional for G Model)

CBM (Cache Backup Module) is an optional equipment for the single-controller Falcon IV. You may need to install CBM on the arrival of your system.

A CBM module contains a battery cell module, and a flash SSD module.

To install a CBM module (Skip steps 1-4 if installing CBM at the initial installation):

Step 1. 1-1. If a system is powered on, stop host I/Os.

1-2. Use the "Shutdown Controller" command to flush cached data.

1-3. Power down the system.

NOTE: If installing a new system, simply remove a RAID controller from its package box. You may then skip steps 2 and 3.

Step 2. Remove RAID controller from chassis by loosening screws under the ejection levers.

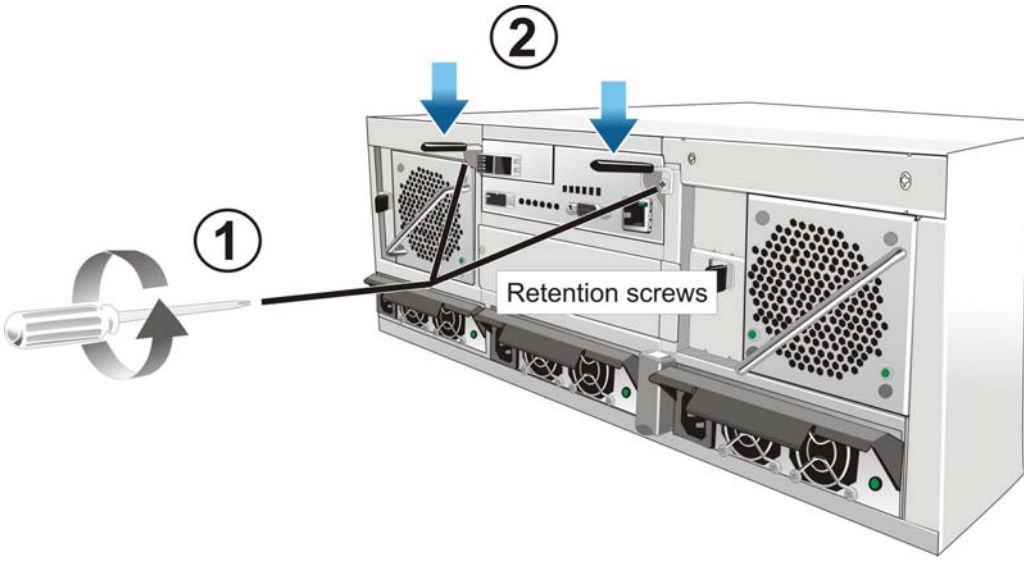


Figure 2-24: Removing a RAID Controller

Step 3. Press down on the ejection levers. The controller will be eased out from chassis.

Step 4. Place controller on a clean, static-free surface. Hold the controller by its metal canister. Never touch the circuit board or connector pins.

Step 5. 5-1. Install BBU by orienting its protruding edge on one end into the insertion slot, and lowering it into the canister. The orientation is shown below.

5-2. Carefully orient the BBU so that the golden finger connector on the BBU is properly aligned with that on the charger board.

5-3. Once the connectors are mated, fasten the captive screw on BBU to secure the installation.

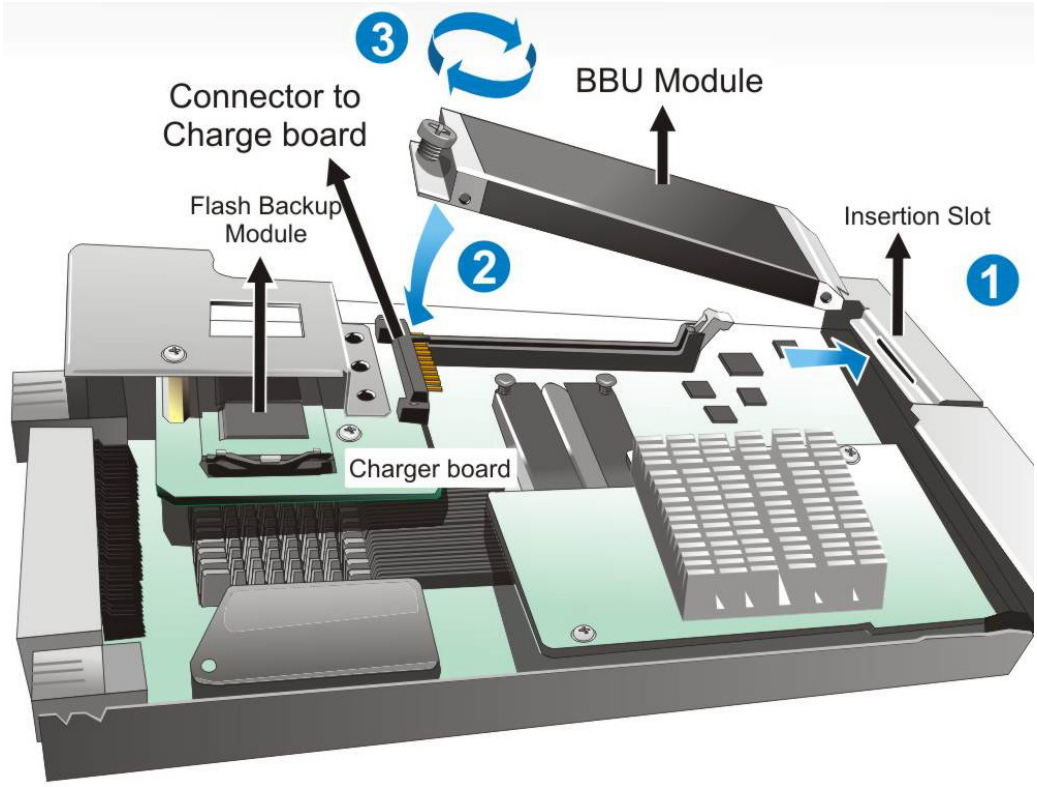


Figure 2-25: Installing BBU Module

Step 6. 6-1. Install the flash SSD by orienting and inserting it at an approximately 15 degree angle into the SSD socket. The SSD socket is located on the charger board.

6-2. Make sure the SSD's golden fingers are fully inserted. Press the SSD down. The retention latches on the SSD socket will hold the SSD in place.

Step 7. Install the RAID controller back into chassis. Insert the controller slowly into the module slot. When you feel the contact resistance by your hands, use more force, and then pull both of the ejection levers upwards to secure the controller into chassis.

Step 8. Secure the controller by fastening two screws you previously removed to the ejection levers.

Chapter 3

System Connections

This chapter outlines some general configuration rules you should follow when cabling a storage system and introduces basic information about Fibre cables and topologies for the Falcon IV system. You can use these topologies or refer to them as a guide for developing your own unique topologies. A complete description of the power on and power off procedures is also given in this chapter.

3.1 FC Host Connection Prerequisites

3.1.1 Choosing the Fibre Cables

The Fibre Channel standard allows for both copper and optical connections. Copper cable is cheaper but limited to lengths of less than 30m (33 yards). Optical cables can be used over longer distances and have been shown to be more reliable. Due to the demands of high transfer rates, optical cables are preferred for 8/4Gbps fiber connectivity. Optical cables are also less susceptible to EMI.

The following transceiver and cables have been tested and proven to be compatible with your systems.

IFT-9370CSFP8GA	Avago AFBR-57D5APZ, Fibre Channel 8.5/ 4.25 / 2.125 GBd Small Form Pluggable Optical Transceiver, LC, wave-length 850nm, multi-mode At 8G mode, the max. cable lengths is 150m with 50µm MMF.
IFT-9270CFCCab01	Optical FC cable, LC-LC, MM-62.5/125, Duplex, LSZH, O.D.=1.8mmx2, 1 Meter

IFT-9270CFCCab02	Optical FC cable, LC-LC, MM-62.5/125, Duplex, LSZH, O.D.=1.8mmx2, 5 Meters
IFT-9270CFCCab03	Optical FC cable, LC-LC, MM-62.5/125, Duplex, LSZH, O.D.=1.8mmx2, 10 Meters

The Fibre host ports connect to Fibre Channel host adapters (HBA) that feature a 8Gbps transfer rate, SFP interface, and support for full-duplex transfer, best come with a 64-bit/133MHz PCI-X or PCI-E interface.

WARNING!

All fiber optic cables are sensitive and must be handled with care. To prevent interference within a rack system, the cable routing path must be carefully planned and the cables must not be bent.

FC Lasers

CAUTION!

Lasers can be hazardous and may cause permanent eye damage or blindness, and therefore must be treated with respect and used with caution. Never look at lasers without confirming that they are off.

Wavelengths: The system supports SFP transceivers using lasers on fiber optic cables emitting short wave (SW) beams (770nm-860nm). Cables using either of these wavelengths can be used.

Laser types: Two (2) types of laser devices can be used in FC cables: Optical Fibre Control (OFC) and non-OFC lasers. The OFC lasers are high-powered and can be used over long distances.

Safety features: Due to their high power output, OFC lasers usually come with a safety mechanism that switches the laser off as soon as it is unplugged. Non-OFC lasers are low power and do not come with these safety features; however, they can still inflict damage.

FC Speed Auto-detection

Speed auto-detection is specified by the Fibre Channel standard. If a 4Gbps port is connected to an 8Gbps port, it will negotiate down and run at 4Gbps. If there are 8Gbps ports on both ends of the link, the link will run at 8Gbps.

SFP Transceivers

An SFP transceiver converts electrical data signals into light signals and transfers them transparently via optical fiber. A transceiver provides bi-directional data links, a laser transmitter (for fiber optic cables), LC connector, and a metal enclosure to lower the EMI.

NOTE:

LC connectors are small form-factor, fiber-optic connectors based on a 1.25-mm ceramic ferrule with the familiar latching mechanism of the RJ-45 modular plug and jack.

Other beneficial features of a typical SFP transceiver include a single power supply, low power dissipation, and hot-swap capability. It is also important that any transceiver you use meets the FC performance and reliability specifications.

CAUTION!

The SFP transceiver from RAID, Inc contains a laser diode featuring class 1 laser. To ensure continued safety, do not remove any covers or attempt to gain access to the inside of the product. Refer all servicing to qualified personnel.

CLASS 1
LASER PRODUCT

FC Port Dust Plugs

Each FC port comes with a dust plug. Remove these dust plugs only when you are ready to insert an SFP transceiver.

Other Concerns

- When selecting the number of hard drives to be included in a logical drive, the host channel bandwidth and the mechanical performance of individual disk drives should be considered.

  It is a good practice to calculate performance against the host port bandwidth when designing an application topology. As diagrammed below, if eight (8) members are included in a logical drive and this logical drive is associated with a host ID (LUN mapping), the combined performance of this logical drive will approximate the channel bandwidth. If, for example, two 8-drive logical arrays are associated with two IDs residing on a single host channel, there may be a trade-off with performance.

  If your system comes with dual controllers for a total of 4 host ports, it will be a good practice you obtain more disk drives by attaching a JBOD so that you can create 4 8- or 12-member logical drives. These 4 logical drives leverage the bandwidth of all 4 host ports.

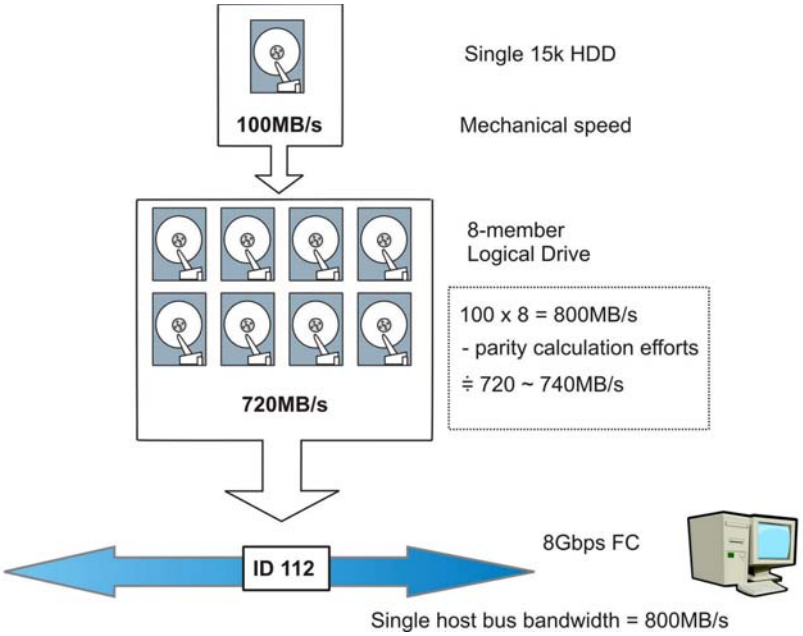


Figure 3-1: Drive Mechanical Speed and Logical Drive Speed

There are other considerations. For example, a spare drive carries no data stripes and will not contribute to disk-level performance. Refer to the documentation for your hard drives for performance data.

- When cabling, follow all the Fibre channel specifications. Pay attention to signal quality and avoid electronic noise from adjacent interfaces, e.g., do not lay power cords on optical cables.

- The disk drives in the same logical array should have the same capacity, but it is preferred that all the drives within a chassis have the same capacity.

- Disk drives in the same logical drive should have the same capacity, but it is preferred that all the disk drives within a chassis have the same capacity. Tiered storage configuration is supported, e.g., 150GB SAS drives in your RAID enclosure and 750GB SATA drives in JBODs. However, you should not include both SAS and SATA drives in a logical drive.

- A spare drive should have a minimum capacity that is equivalent to the largest drive that it is expected to replace. If the capacity of the spare is less than the capacity of the drive it is expected to replace, the controller will not proceed with the failed drive rebuild.

- When rack-mounted, leave enough slack in the cables so that they do not bend to a diameter of less than 76mm (3 inches).

- Route the cables away from places where it can be damaged by other devices, e.g., foot traffic or fan exhaust.

- Do not overtighten or bend the cables.

3.1.2 Topology and Configuration Considerations

Fibre Channel Topologies

The Fibre Channel standard supports three (3) separate topologies. They are point-to-point, Fibre Channel Arbitrated Loop (FC-AL), and fabric switch topologies.

- **Point-to-Point:** Point-to-point topology is the simplest topology. It is a direct connection between two (2) Fibre Channel devices.
- **FC-AL:** This is the most common topology currently in use. Fibre Channel devices are all connected to a loop. Each device is assigned an arbitrated loop physical address (AL_PA). The FC-AL supports 124 devices in a single loop.
- **Fabric:** The fabric topology supports up to 2^{24} Fibre Channel devices. This topology allows many devices to communicate at the same time. A Fibre switch is required to implement this topology.

Host-side Topologies

The primary concern for configuring host-side topologies is to avoid points of failure. It is therefore recommended that the host ports be connected to at least two (2) HBAs. It is also preferable to apply Fibre Channel switches.

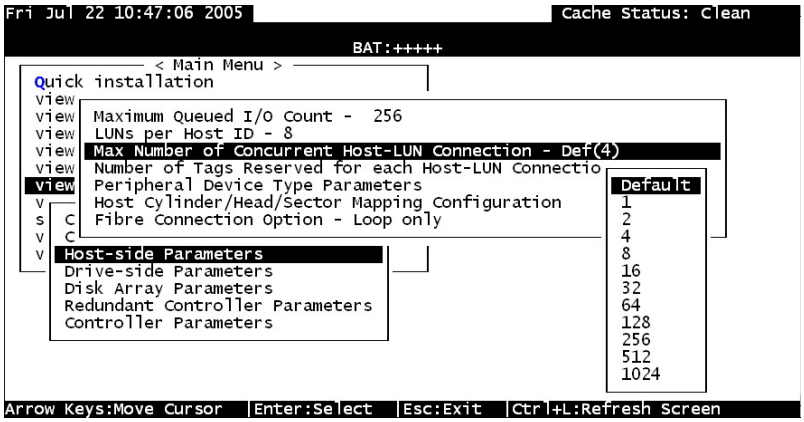
NOTE:

In order to manage the fault-tolerant data paths and to optimize data throughput on multiple data paths, it is necessary to apply RAID, Inc's Multipathing software or other utilities such as Linux Device Mapper, etc.

Associated Host-side Parameters

It will be necessary to fine-tune your host-side parameters if you are attaching the system in a complex, multi-host SAN environment. The options can be found in terminal console with firmware in Main Menu -> View and Edit Configuration Parameters -> Host-side Parameters. For example, you may need to enlarge values for the following parameters:

Maximum Concurrent Host LUN Connection ("Nexus" in SCSI)



The "Max Number of Concurrent Host-LUN Connection" menu option is used to set the maximum number of concurrent host-LUN connections. Change this menu option setting only if you have more than four logical drives or partitions. Increasing this number might increase your performance.

Maximum concurrent host LUN connection (nexus in SCSI) is the arrangement of the controller internal resources for use with a number of the current host nexus.

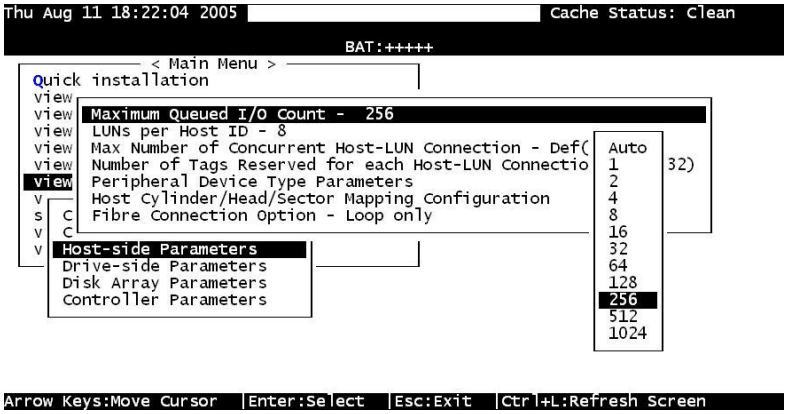
For example, you can have four hosts (A, B, C, and D) and four host IDs/LUNs (IDs 0, 1, 2 and 3) in a configuration where:

- Host A accesses ID 0 (one nexus).
- Host B accesses ID 1 (one nexus).
- Host C accesses ID 2 (one nexus).

These connections are all queued in the cache and are called four nexus.

If there is I/O in the cache with four different nexus, and another host I/O comes with a nexus different than the four in the cache (for example, host A accesses ID 3), the controller returns busy. This occurs with the concurrent active nexus; if the cache is cleared, it accepts four different nexus again. Many I/O operations can be accessed via the same nexus.

Maximum Queued I/O Count



The "Maximum Queued I/O Count" menu option enables you to configure the maximum number of I/O operations per host channel that can be accepted from servers. The predefined range is from 1 to 1024 I/O operations per host channel, or you can choose the "Auto" (automatically configured) setting. The default value is 256 I/O operations.

The maximum number of queued I/O operations is 4096.

The appropriate "Maximum Queued I/O Count" setting depends on how many I/O operations attached servers are performing. This can vary according to the amount of host memory present as well as the number of drives and their size. If you increase the amount of host memory, add more drives, or replace drives with higher performance, you might want to increase the maximum I/O count. But usually optimum performance results from using the "Auto" or "256" settings.

For more information, please refer the firmware Operation Manual that came with your system.

3.2 Sample Topologies

Sample 1: DAS (Direct-Attached) Connections (Falcon IV).

NOTE:

If a logical drive can be accessed by different servers, file locking or multi-pathing access control will be necessary.

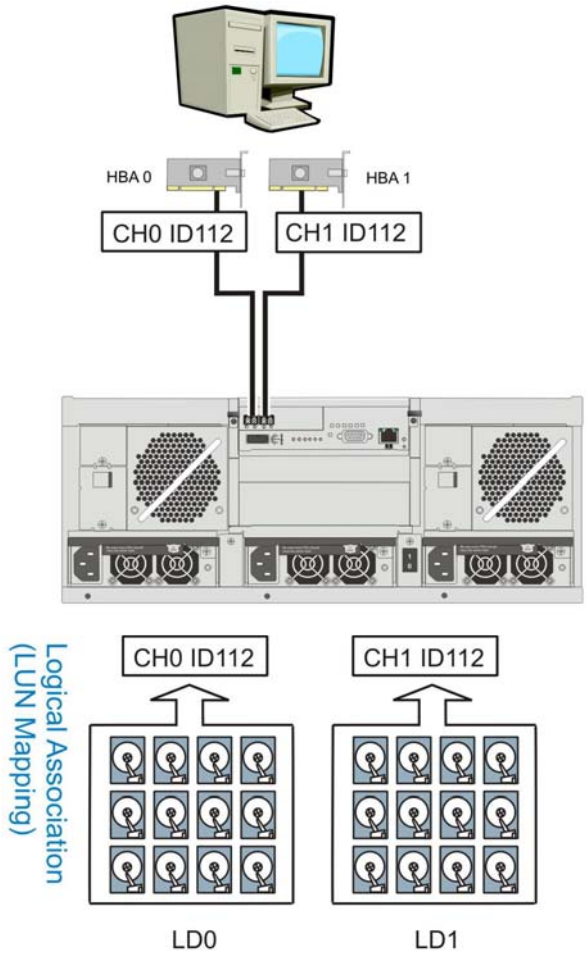


Figure 3-2: DAS Connections, Falcon IV

Channels	Controller A
Host	CH0 and CH1

Configuration Information	
RAID controllers	1
Host servers	1
Data path connection	Simple end-to-end connections
Host channel bandwidth	1600MB/s

With more disk drives over the SAS expansion links, you can create more logical groups of drives. Avail these logical drives using more host channel IDs or LUN numbers.

Sample 2: DAS (Direct-Attached) Connections (Falcon IV).

NOTE:

If a logical drive can be accessed by different servers, file locking or multi-pathing access control will be necessary.

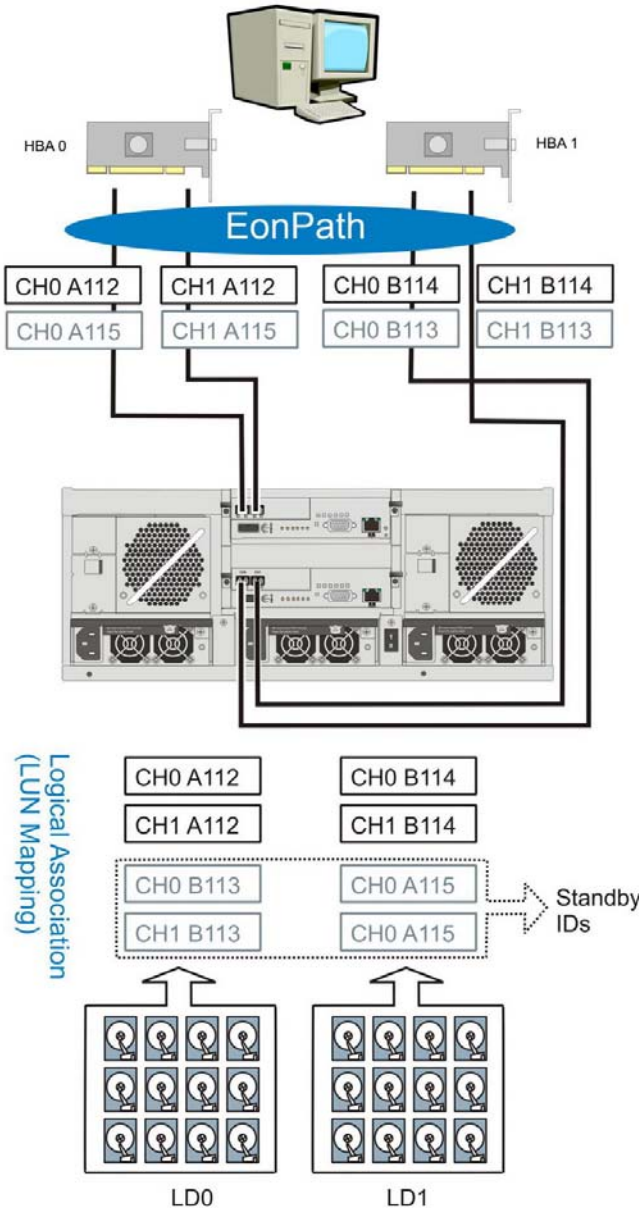


Figure 3-3: DAS Connections, Falcon IV

Channels	Controller A	Controller B
Host	CH0 & CH1	CH0 & CH1

Configuration Information

RAID controllers	2
Host servers	1
Data path connection	Fault-tolerant data paths
Host channel bandwidth	3200MB/s

With more disk drives over the SAS expansion links, you can create more logical groups of drives. Avail these logical drives using more host channel IDs or LUN numbers.

Each logical drive is redundantly mapped to multiple host channel IDs in an AAPP (Active-Active-Passive-Passive) configuration. The Passive IDs will only become functional when a single controller fails in the system. The Multipath driver is a must on the application server. The driver communicates with system firmware and performs load balance and automated distribution of I/Os across preferred paths (Active IDs on data paths). TPGS (Target Port Group Service) is supported.

Sample 3: Simple End-to-End Connections (Falcon IV).

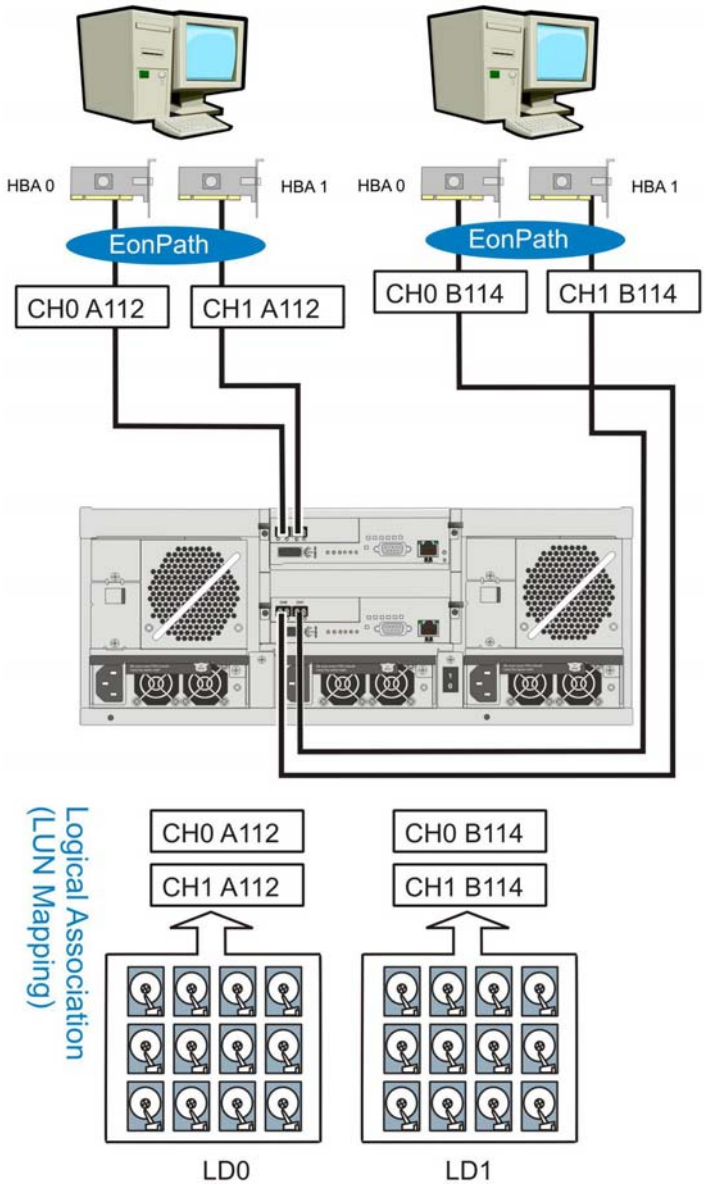


Figure 3-4: Simple End-to-End Connections

Channels	Controller A	Controller B
Host	CH0 & CH1	CH0 & CH1

Configuration Information	
RAID controller	2
Host server	2
Data path connection	Fault-tolerant data paths, yet LD can not failover to a partner controller in the event of controller failure.
Host channel bandwidth	3200 MB/s

Above is the sample drawing showing simple end-to-end connections with each SFP port connected to a host adapter. Multiple logical drives can be created and each mapped to the corresponding host channel ID/LUN combinations.

Note that RAID, Inc's Multipathing software is necessary for controlling and optimizing the access to logical drives via multiple data paths.

Sample 4: Switched Fabric Connections (Falcon IV).

IMPORTANT!

If you connect fault-tolerant links via FC switches in a redundant-controller configuration, make sure the corresponding switch ports are configured as “FL_ports.” In the event when a RAID controller fails, a LIP is issued across and if the switch ports are configured otherwise, FC switches may not acknowledge the change in data routes.

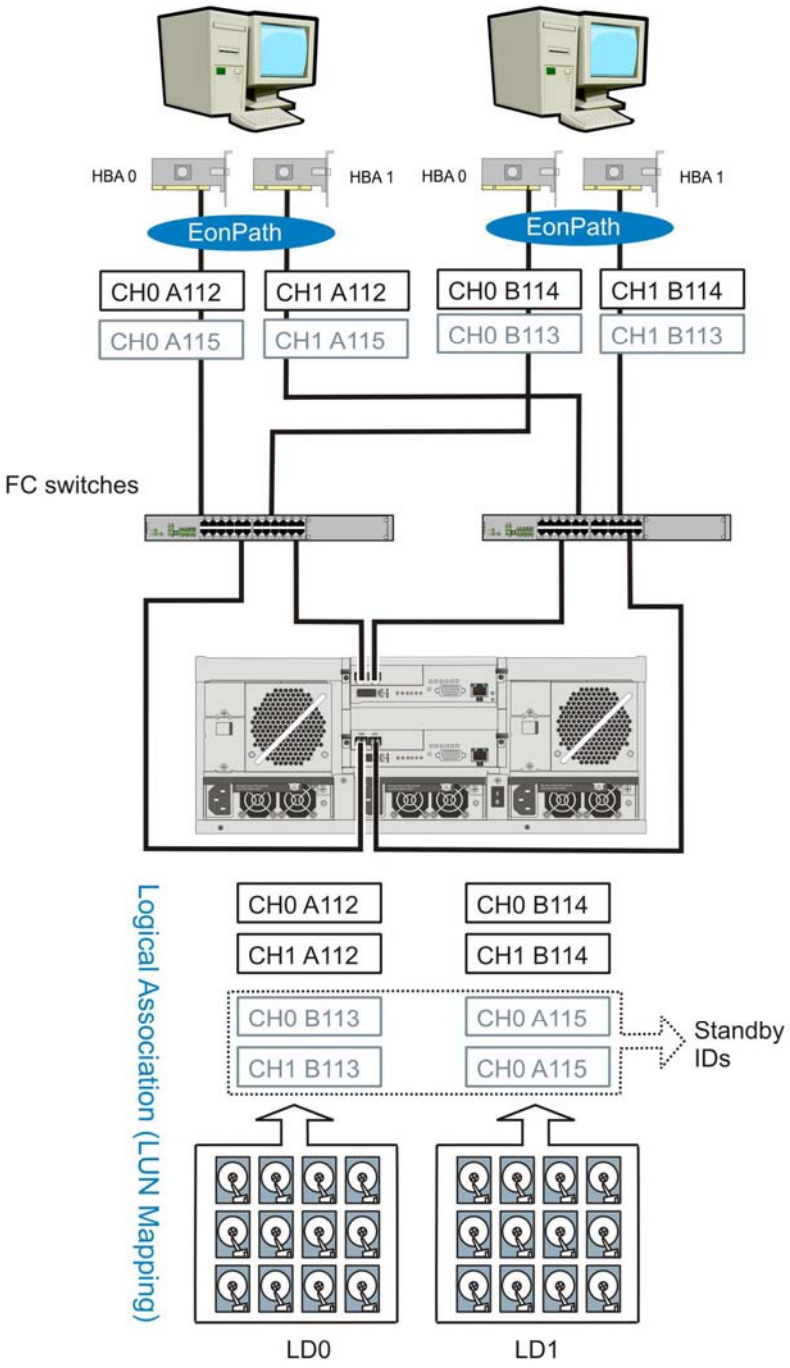


Figure 3-5: Connections via Switched Fabric

Channels	Controller A	Controller B
Host	CH0 & CH1	CH0 & CH1

Configuration Information	
RAID controller	2
Host server	2 (or more via FC switches)
FC switch	2 (or 1 into 2 zones)
Data path connection	Fault-tolerant paths
Host channel bandwidth	3200MB/s

Channel link bypass is provided on external FC switches. Each of the application servers shown in the diagram is equipped with two HBAs with FC links via two FC switches to the SFP ports on individual RAID controllers.

You can refer to the ID tags on the host links to see the related logical drive mapping and cable links routing paths. Through the cable links diagrammed above, the configuration can withstand a failure of a single component, e.g., RAID controller, HBA, cable, or FC switch.

Each logical drive is redundantly mapped to multiple host channel IDs in an AAPP (Active-Active-Passive-Passive) configuration. LD0 is assigned to controller A, and LD1 is assigned to controller B. The Passive IDs will only become functional when a single controller fails in the system. The driver is a must on the application servers. The driver communicates with system firmware and performs load balance and automated distribution of I/Os across preferred paths (Active IDs on data paths). TPGS (Target Port Group Service) is supported.

3.3 FC Cabling

Following are steps that should be completed with cabling:

1. Maintain a configuration plan. In addition to cabling topologies and list of networking components, the plan can also include firmware and software maintenance details.
2. Confirm that you have a Fibre Channel cable loops 6-inch or longer.
3. Ensure proper airflow and keep cables away from ventilation airflow outlets.

Cabling Steps:

Step 1. Remove the SFP module from its static-protective package.

Step 2. Remove the dust plug from the SFP transceiver module. Save the dust plug for future use.

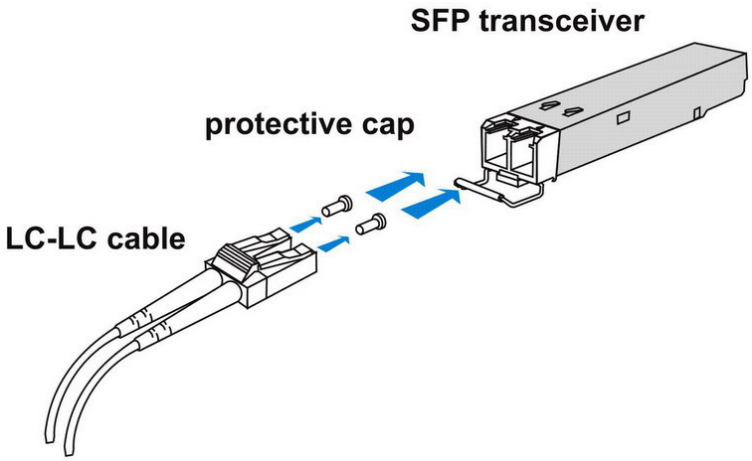


Figure 3-6: Connecting SFP Transceiver and LC Type Cables

Step 3. Remove the dust plugs from the RAID system SFP ports.

Step 4. Insert the SFP module into the system host ports. The module will click into place.

Step 5. Connect an LC-to-LC type cable.

Step 6. Remove the two protective caps from the LC-to-LC type cable. Save the protective caps for future use.

Step 7. Carefully insert the cable into an SFP module that is already on the system. The cable connector is keyed and will click into place.

Step 8. Remove the protective caps on the other end and connect this end to an SFP transceiver module on a Fibre Channel switch port or a Fibre Channel host bus adapter (HBA) port.

3.4 Expansion Links

Expansion Links:

The SAS expansion port connects to expansion enclosures. For a dual-controller system, each expansion port connects a RAID controller to a corresponding JBOD controller making fault-tolerant links to different SAS domains.

There are two principles with the combinations of RAID and JBOD:

1). Dual-controller RAID connects to dual-controller JBODs; Single-controller RAID connects to single-controller JBODs.

2). You should have one or two cables for JBOD connections.

These two connector types are both made for 4x multi-lane SAS connections, only that their form factors and latching mechanisms are different.

RAID Model	3U JBOD	Configuration
Falcon IV		Dual-controller; fault-tolerant paths
Falcon IV		Single-controller; single path

Table 3-1: Falcon IV RAID and JBOD Matching Table

Enclosure ID:

There is a rotary ID switch on every expansion enclosure that is manually configured using a flat blade screwdriver.

Configuring enclosure IDs:

1. The configurable IDs start from 2 to 6. Usually the numbering starts from the one closest to the managing RAID enclosure. The first two IDs, **0** and **1**, are occupied by the RAID enclosure.

2. The Falcon IV connects to a maximum of **5** JBODs, making a total of 104 HDDs.

3. Make sure a unique ID is configured on each JBOD so that the SAS WWN addresses of disk drives can be properly assigned. RAID system firmware automatically manages these addresses.

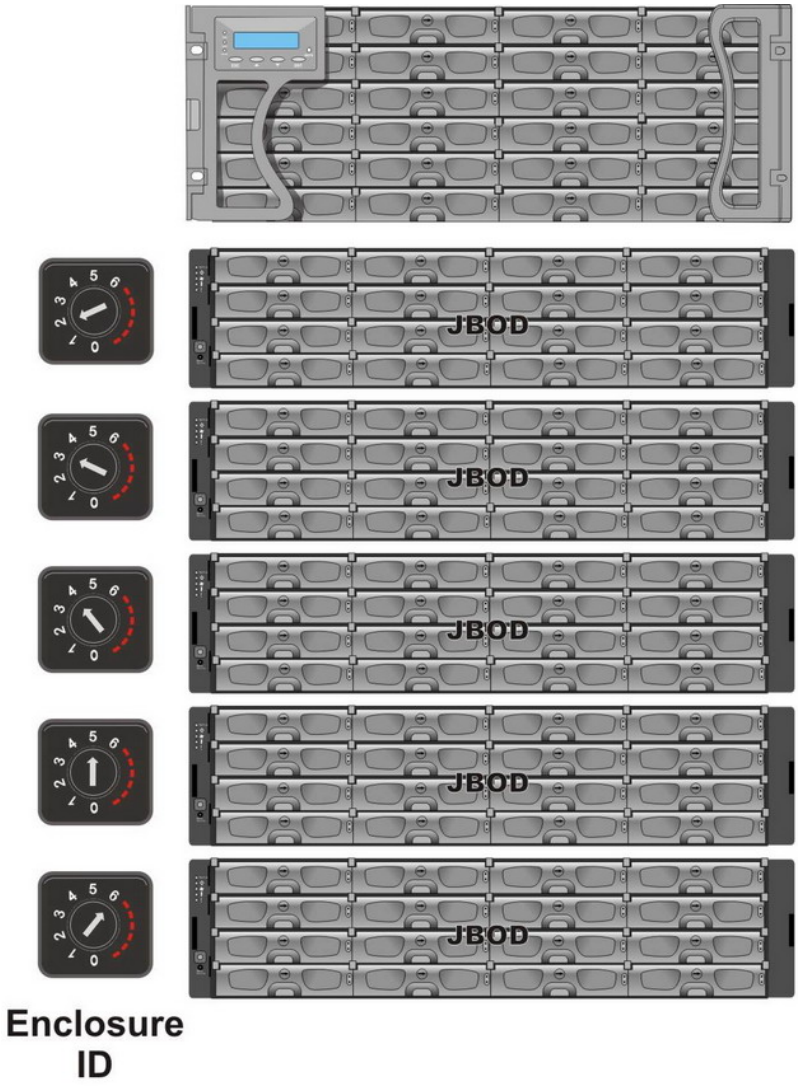


Figure 3-7: JBOD Enclosure IDs

SAS Expansion Configuration

Physical Connections from a Redundant-controller RAID to 3U Dual-controller JBODs: Falcon IV

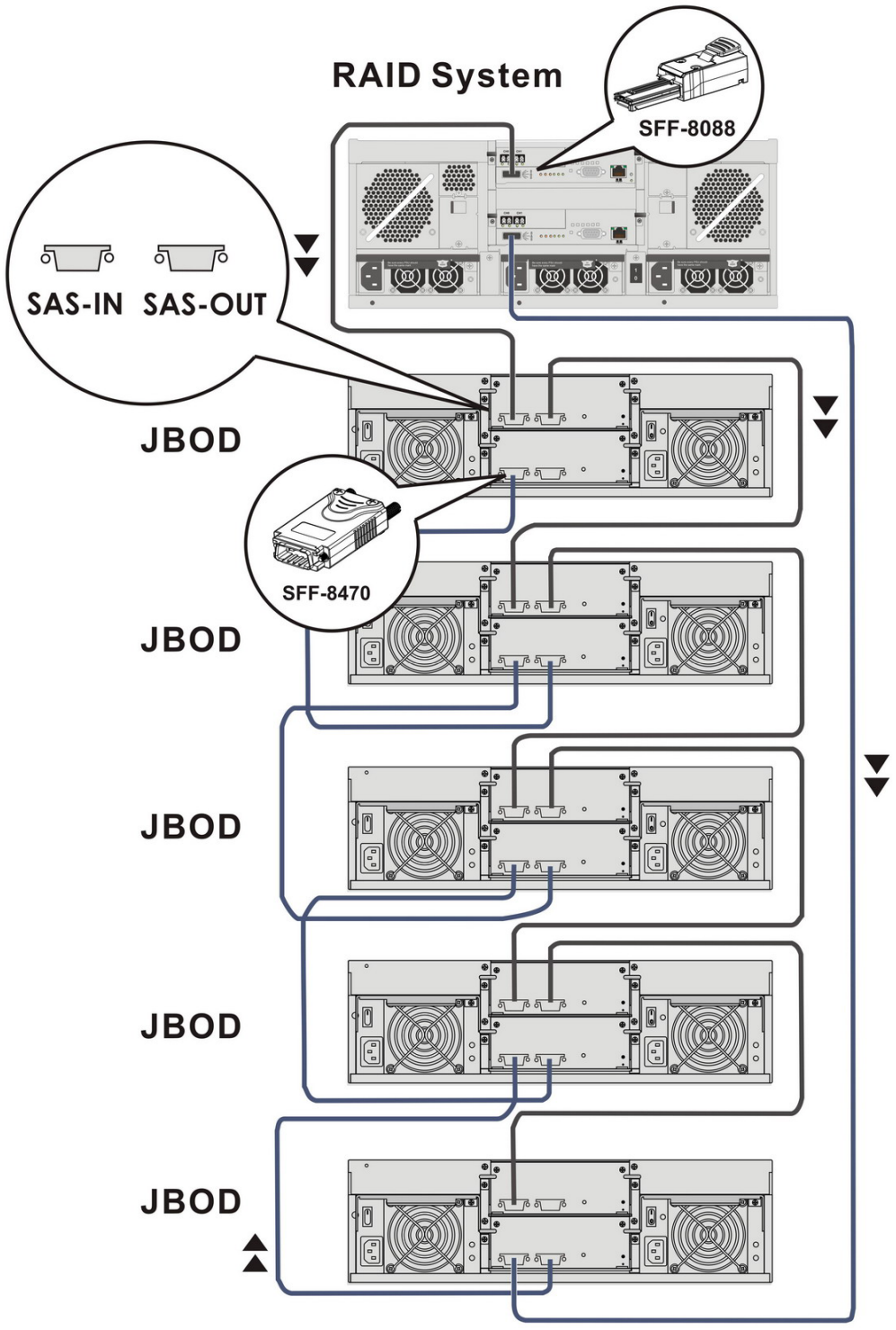


Figure 3-8: Redundant-controller RAID to 3U Dual-controller JBODs

Configuration Rules:

Following are the rules for connecting SAS interfaces across RAID and JBOD enclosures:

1. If SATA drives are deployed in a configuration consisting of dual-controller enclosures, make sure MUX boards are available for all disk drives.

2. Fault-tolerant links in a dual-controller combinations: Corresponding to SAS drives' **dual-ported** interface, two (2) physical links are available from each disk drive, routed across the backplane board, each through a SAS expander, and then interfaced through a 4x wide external SAS port.

   With data paths through separate SAS domains, access to disk drives can be continued in the event of a cable link or SAS JBOD controller failure.

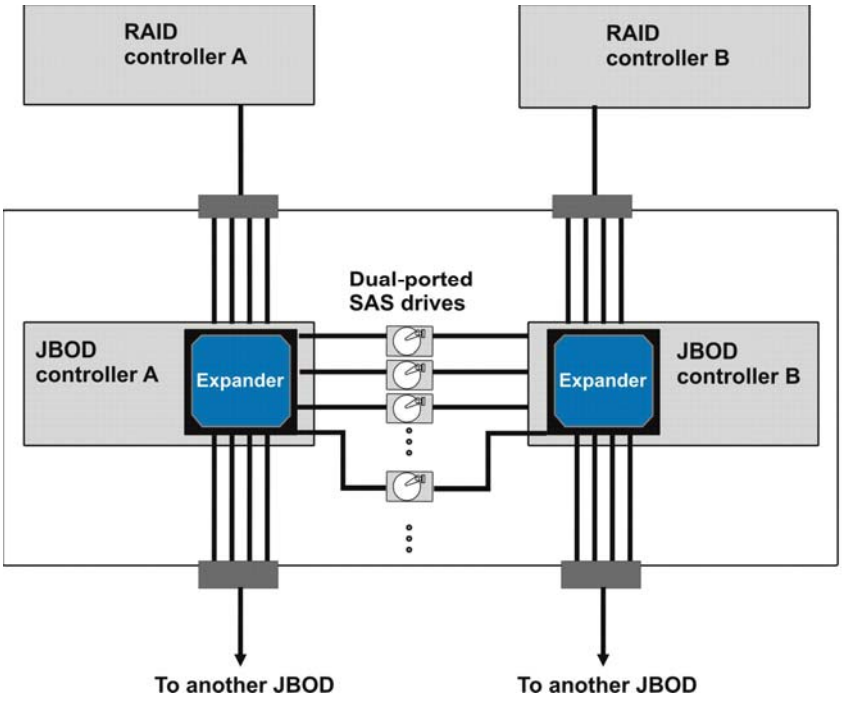


Figure 3-9: Fault-tolerant Links to SAS disk Drives

3. SAS expansion cables will be available with RAID, Inc's JBODs. Note that if many JBODs are connected, a longer SAS external cable (e.g., a 120cm or 160cm cable) may be necessary for connecting a JBOD from the opposite direction offering high redundancy.

   One expansion link connects JBODs from the nearest JBOD, and then to the farthest JBOD. Another expansion link connects to the farthest JBOD from the opposite direction and then to the nearest JBOD. Connected this way, even an entire JBOD failed in the configuration, the connections to other JBODs will still be available.

4. Each expander controller on the SAS JBOD controls a "**SAS Domain**" that connects one of the alternative interfaces on all of

the disk drives in the enclosure. For example, one expander unit controls Domain A, and the other controls Domain B. In a fault-tolerant topology, the SAS external links always connect to the SAS ports on the same SAS Domain.

The SAS Domains can be identified by the expanders' locations, i.e., upper controller slot (Controller A/Slot A) or the lower controller slot (Controller B/Slot B).

5. On a RAID system, each RAID controller can be considered as managing a separate SAS Domain. With the help of the port selector mechanism on the MUX boards, the idea of SAS Domain applies even when SATA drives are used in a dual-controller JBOD.

Single-controller RAID to 3U single-controller JBODs:

Falcon IV

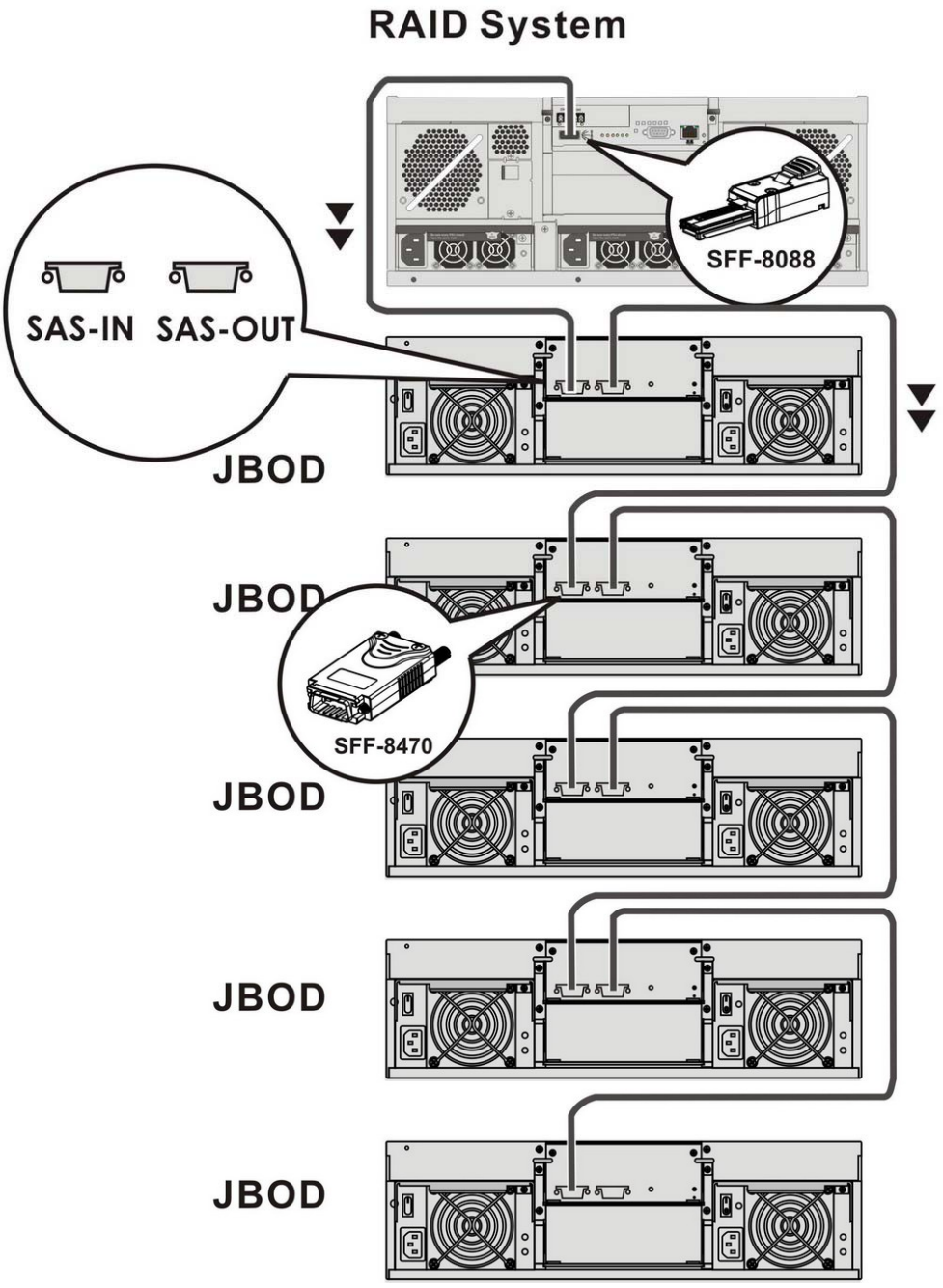


Figure 3-10: Single-controller RAID to 3U Single-controller JBODs

NOTE:

Because of the different port connectors on RAID and JBODs, an SFF-8088 to SFF-8470 cable will be necessary when connecting to 3U single-controller JBODs.

3.5 Connecting Other Interfaces

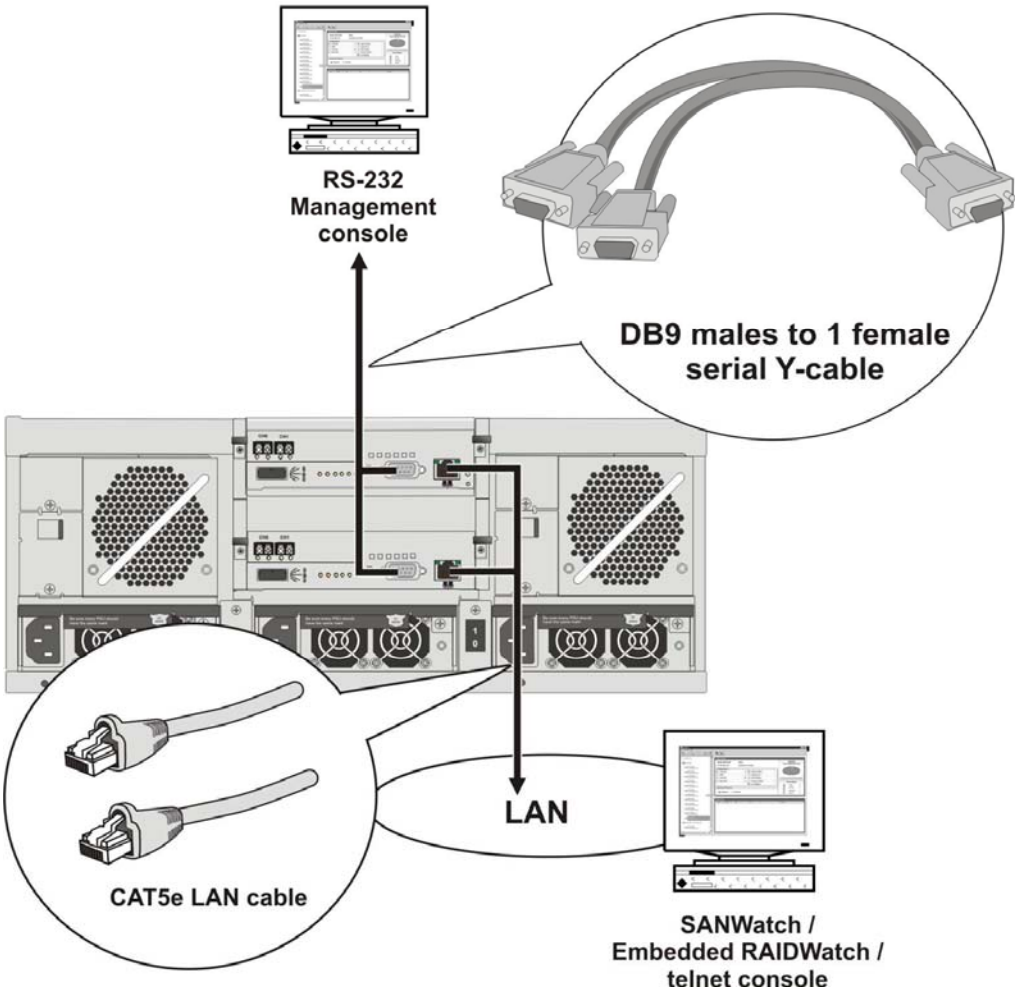


Figure 3-11: Connecting Serial Port and Ethernet Ports

Single-controller Falcon IV: Serial cable and LAN cable are user-supplied.

Dual-controller Falcon IV: A serial port Y-cable is provided in package. LAN cable is user-supplied.

The serial port's defaults are:

Baud rate	38400
Data bit	8
Parity	none
Stop bit	1
Flow control	Hardware

Table 3-2: Serial Port Defaults

For TCP/IP connection and firewall configuration with a management station running SANWatch, please refer to SANWatch's online help or User's Manual.

3.6 Connecting Power Cords

Use the included cable clamps to secure power cord connections.

Step 1. Remove power cords and cable clamps from the accessory boxes.

Step 2. Combine cable straps with cable clamps.

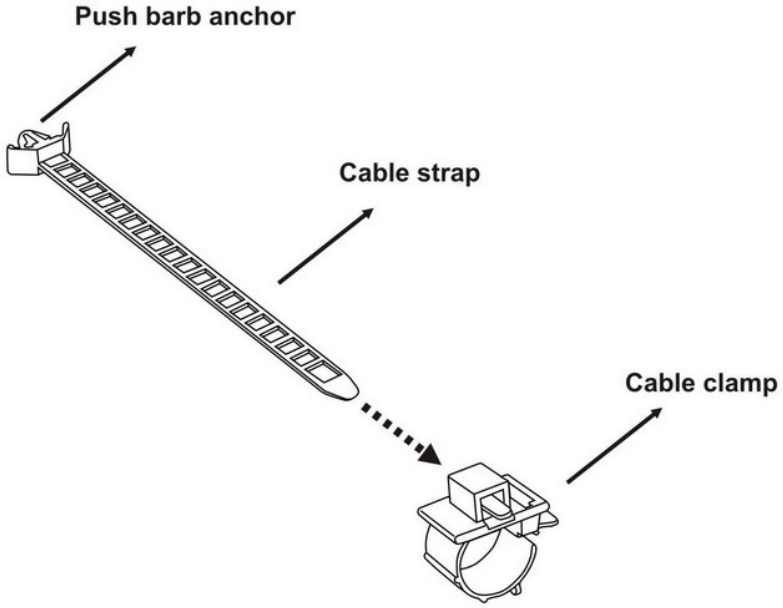


Figure 3-12: Combining Cable Strap and Cable Clamp

Step 3. Attach cable clamps to the power cords by opening and enwrapping the plastic ring around the base of power cords.

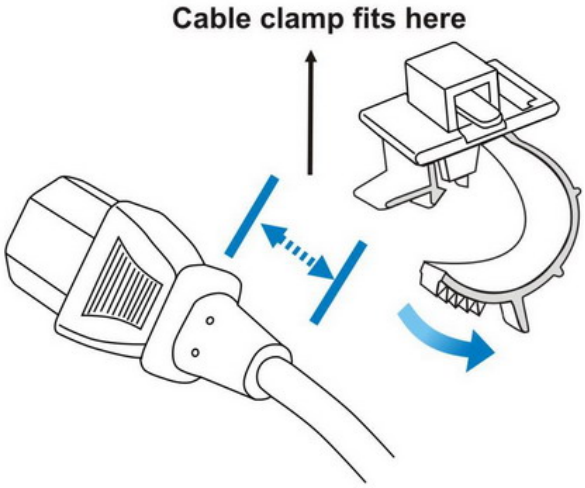


Figure 3-13: Attaching Cable Clamps to Power Cords

Step 4. Adjust the position of cable straps using the release tab. Adjust the position so that when a power plug is connected to system power the barb anchor can be inserted into the anchor hole above the power socket.

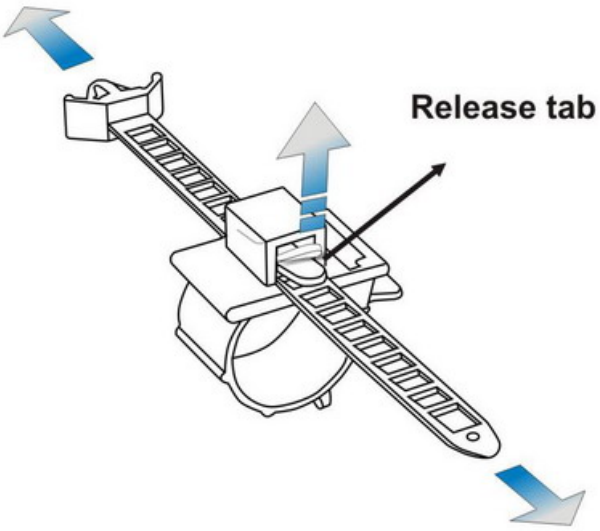


Figure 3-14: Adjust Cable Strap Position

Step 5. Connect power cords to system power supplies and insert the barb anchor into the anchor holes below the power sockets.

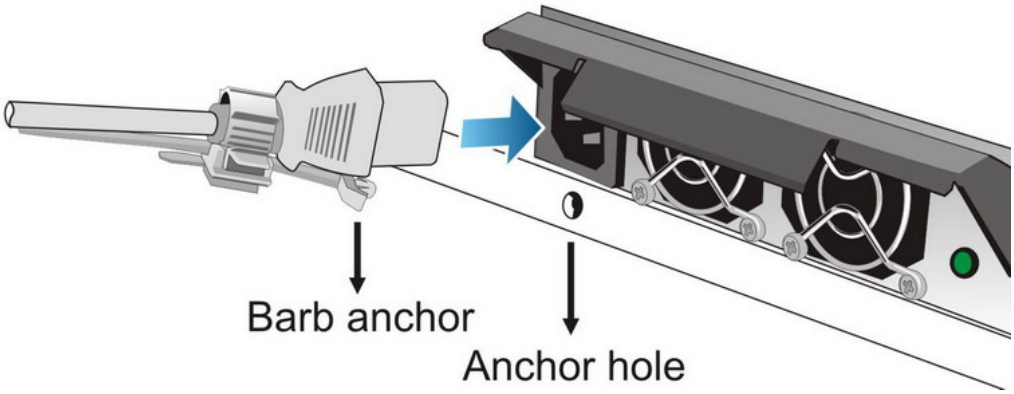


Figure 3-15: Attaching Power Cords

3.7 Power On

Once all of the components have been installed in the system and the cabling links have been adequately connected, the system can be powered on.

Check List

BEFORE powering on the subsystem, please check the following:

- **CBM:** Make sure CBM has been installed correctly (CBM selected as an add-on module for G1840).

- **Hard drives:** Hard drives have been installed in the drive trays.
- **Drive trays:** All the drive trays, whether or not they contain a hard drive, have been installed into the system.
- **Cable connections:** The subsystem has been correctly connected to host computer(s), FC switches or HBAs, and SBODs.
- **Power cords:** The power cords have been connected to the PSUs on the subsystem and plugged into the main power source.
- **Ambient temperature:** All the subsystem components have been acclimated to the surrounding temperature.

Power On Procedure

When powering on the subsystem, please follow these steps:

Step 1. **Power on the Fibre Channel networking devices.**

These devices include FC switches, and any other such devices connected between application servers and storage. Please refer to the documentation that came with your networking devices to see the power-on procedure.

Step 2. **Power on the expansion enclosures (JBOD) attached to the RAID system.**

If you have connected JBODs to the system, power on these JBODs, and wait for their Drive Busy LEDs to blink.

Step 3. **Power on the system.**

The system should be powered on before the application servers. Power on using the power switch that is covered by a plastic cap.

Step 4. **Power on the application servers (host computers.)**

The application servers should be the last devices that are turned on. Please refer to related documentation for their power-on procedures.

Power On Status Check

Once the system is powered on, all aspects of its operating statuses should be carefully observed to ensure that there are no complications or malfunctions.

1. **Controller module LEDs:** The Controller Ready, Host Busy, and Drive Busy LEDs should all flash green during the initialization process.

2. **Drive tray LEDs:** The green LEDs for all populated drive trays should light constant blue after the initialization process.

3. **LCD panel LEDs:** The Power LED on the LCD panel should light blue, and the ATTEN LED should be flashing red during the initial stage and turns off once the initialization is completed.

4. **Fibre Port LEDs*:*** The LEDs underneath each FC port should illuminate green, indicating that the Fibre Channel link has been established.

5. **BBU LEDs:** The LEDs on the BBU rear panel should start flashing amber, indicating that the BBU is being charged.

6. **PSU LEDs:** If the PSU is operating normally and experiencing no problem after power on, the LEDs on the PSU should light green constantly.

7. **Firmware and RAIDWatch:** Various aspects of the system operating information can be accessed through the firmware configuration utilities or the RAIDWatch GUI.

8. **Audible alarm:** If any errors occur during the initialization process, the onboard alarm will sound in a hastily repeated manner.

9. Drive BUSY LEDs should start flashing during the power-up process, indicating that the RAID controllers are attempting to access the hard drives.

NOTE:

The subsystem has been designed to run continuously. If a component fails, the fault can be corrected online.

LCD Screen

When powering on the subsystem, wait for the front panel LCD screen to show "**READY**" or "**No Host LUN**" before you power up the application servers.

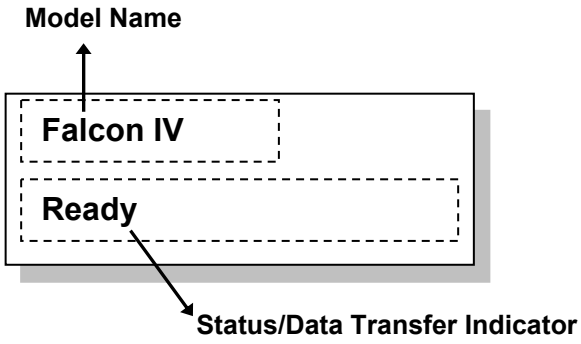


Figure 3-16: The LCD Initial Screen

The LCD screen startup sequence is shown and described in the sequence below:

Initializing…. Please Wait...	This screen appears when the system is powering on.
Power On Self Test Please Wait…	System is performing a self test.
Power on Init Completed..	System power-on self test is completed.
Falcon IV	System is accessing various interfaces.
Falcon IV 512MB RAM, Wait...	Verifying installed memory.
Falcon IV No Host LUN	System is ready. You can now start to configure the system.
Falcon IV Ready	With host LUN mapping, system is ready for I/Os.

3.8 Power Off Procedure

If you wish to power down the subsystem, please follow these steps:

NOTE:

If you wish to power down the subsystem, please make sure that no time-consuming processes, like a "logical drive parity" check or a "background scrub," are running.

Step 1. **Stop I/O access to the system.**

Close your applications to stop all IO accesses to the subsystem. Please refer to the documentation that came with your applications.

Step 2. **Flush the cache.**

Locate the C_Dirty LED on the controller module to check if there is still cached data in memory. Use the **Shutdown Controller** firmware function to flush all cached data. This prepares the RAID subsystem to be safely powered down.

Step 3. **Turn off the power.**

Once the subsystem has been powered down, other enclosures attached to the subsystem may be sequentially powered down.

Chapter 4

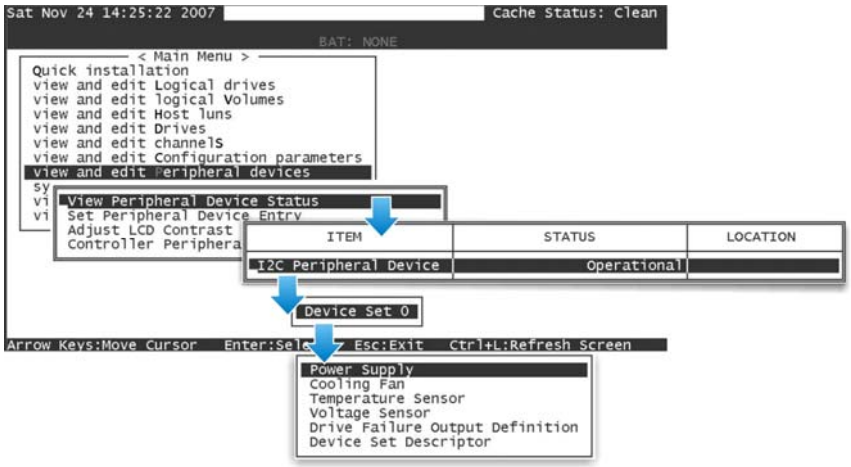
System Monitoring

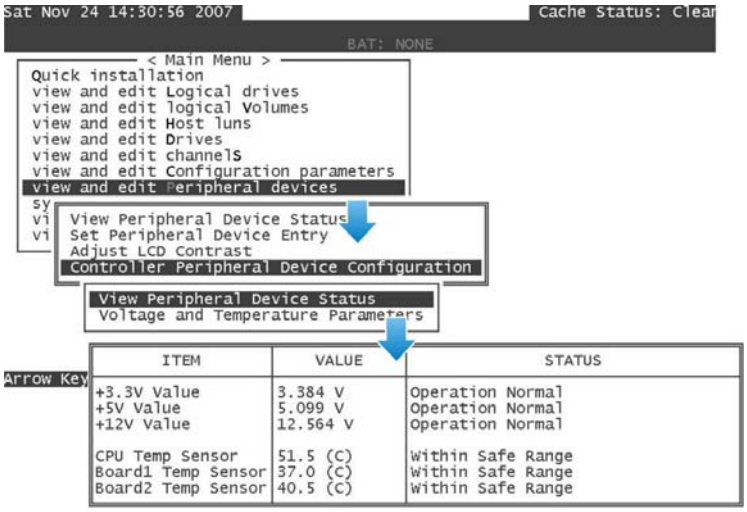
4.1 Overview

The S16F system is eq uipped with a variety of self-mo nitoring features that help keep system managers aware of system operation statuses.

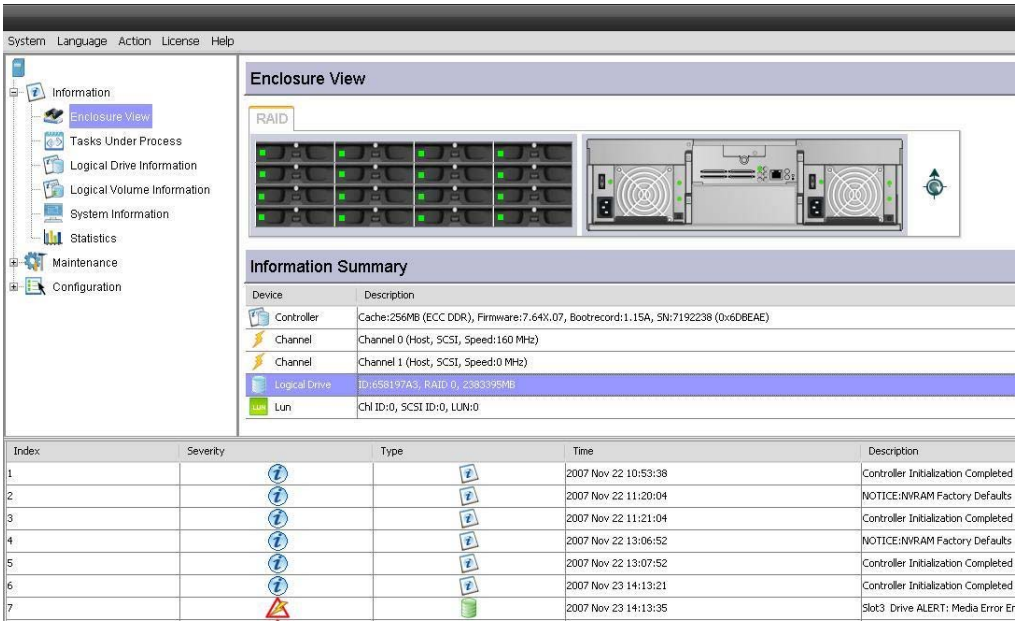
The monitoring features include:

- **Firmware**: The RAID con troller in the system is ma naged by a pre-installed firmware, wh ich is acce ssed u sing a PC hyper-terminal via the COM1 serial port. Device statuses can b e obtained from the menu-driven co nfiguration utility. Firmwar e features are fully described in the **Operation Manual** that cam e with your system.

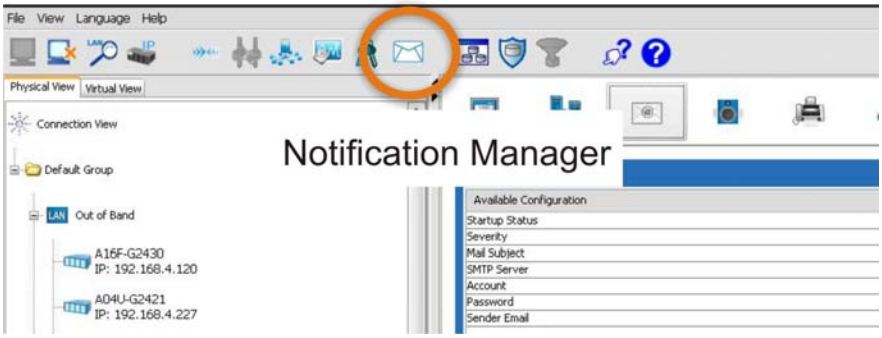




- **SANWatch:** SANWatch is a fully integrated, Java-based, Graphical User Interface (GUI) that came with the system and can be used to monitor and maintain the sub system locally or remotely over TCP/IP network. The management session is made using the 10/100BaseT management port. Please refer to the **SANWatch User's Manual** for further details.



Use SANWatch's Notification Manager to set up automated event notification via Email, MSN, LAN broadcast, etc.



- **LEDs**: LEDs are located on all modules. These LEDs indicate the integrity of a given component or a host/management link. You should become familiar with the various LEDs and their definitions.

- **Audible alarm:** An audible alarm is present on the system controller board and will be triggered if any of a number of threatening events occurred.

4.2 Status-indicating LEDs

4.2.1 LCD Keypad Panel

The LCD keypad as shown in **Figure 4-1** consists of five (5) buttons, three (3) LEDs, and a 16x2-character LCD screen that provides access to firmware-embedded utility. Press the **ENT** button for two (2) seconds on the initial screen to enter the main menu. Press the **ESC** button to skip the current event.

Function Keys:

Press the **UP** and **DOWN** arrow keys to select viewing items. In the bottom row of the main menu, "View and Edit Event Logs," the most recent event is displayed.

Browsing Events:

To see detailed description of each event, use the arrow keys to select an event, and press and hold down the **ENT** key until an event ID is shown on the screen, then use arrow keys to browse through the description lines. If you tab the **ENT** key lightly, system will prompt you to delete all events.

Mute Button:

The **MUTE** button silences the alarm temporarily until the next event occurs.

The definitions of LEDs on the panel are given in **Table 4-1** below.

Figure 4-1: LCD Keypad Panel

Name	Color	Status
PWR (Power)	Blue	**ON** indicates that power is supplied to the system, and system state is normal. **OFF** indicates that no power is supplied to the system or the RAID controller has failed.
BUSY	White	**FLASHING** indicates that there is active traffic on the host/drive channels. **OFF** indicates that there is no activity on the host/drive channels.
ATTEN (Attention)	Red	**ON** indicates that a component failure/status event has occurred. **OFF** indicates that the subsystem and all its components are operating correctly.

Table 4-1: LCD Panel LED Definitions

NOTE:

During the power-on process, the ATTEN LED will light up steadily. Once the subsystem successfully boots up with no faults, the ATTEN LED will turn off.

4.2.2 Drive Tray LEDs

Two (2) LED indicators are located on the right side of each drive tray. Refer to **Table 4-2** for the LED definitions. When notified by a drive failure message, you should check the drive tray indicators to find the correct location of the failed drive. Replacing the wrong drive can fail two members of a logical array (RAID 3/5) and thus destroy data in it.

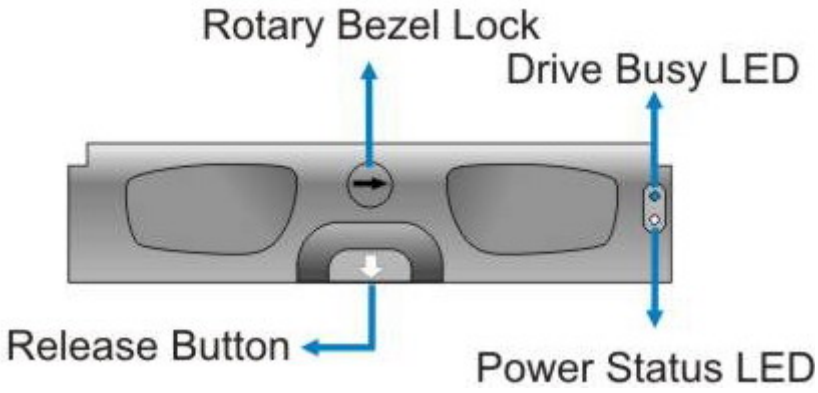


Figure 4-2: Drive Tray LEDs

Name	Color	Status
Drive Busy	Blue	**FLASHING** indicates data is being written to or read from the drive. The drive is busy. **OFF** indicates that there is no activity on the disk drive.
Power Status	Green/ Red	**GREEN** indicates that the drive bay is populated and is working normally. **RED** indicates that the disk drive has failed, or a connection problem occurred.

Table 4-2: Drive Tray LED Definitions

4.2.3 Controller Module LEDs

The LEDs on the rear-facing faceplate of the RAID controller are shown in **Figure 4-3**. The controller LEDs are numbered from 1 to 6. The definitions are shown below.

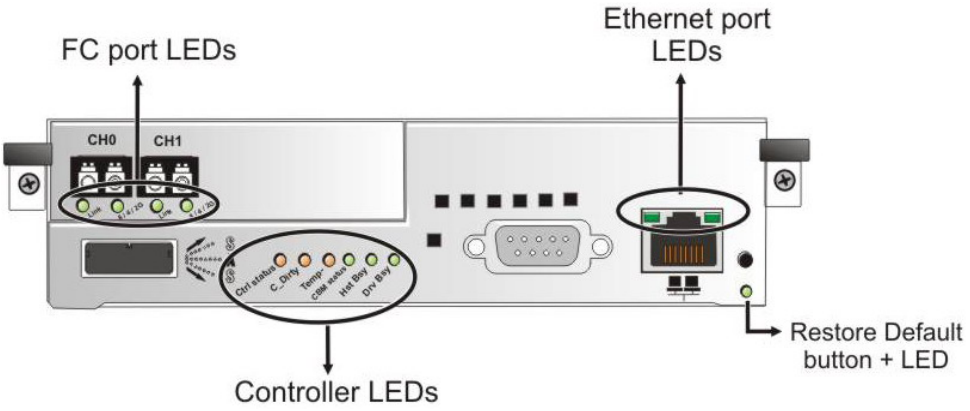


Figure 4-3: Controller Module LEDs

Name	Color	Status
Ctlr Status	Green/ Amber	**Green** indicates that a RAID controller is operating healthily. **Amber** indicates that a component failure has occurred, or inappropriate RAID configurations have caused system faults. It is also lit during the initialization process.
C_Dirty	Amber	**ON** indicates the following: - Certain amounts of cached data held in memory. - Errors occurred with cache memory (ECC errors) - Cached data is sustained by battery backup. - Battery voltage is lower than 2.5V. - Battery temperature reading is abnormal (out of the 0 to 45°C range). - Battery is not present. **OFF** indicates that the cache is clean, and that the battery backup unit is capable of sustaining memory in case of power loss. This signal is local to each controller.
Temp.	Amber	**ON** indicates that the detected CPU/board/chassis temperature has exceeded the higher temperature threshold. **OFF** indicates that the detected temperature reading is within the safe range.
CBM Status	Green/ Amber	**Green** steady on indicates the CMB module is ready. Both a BBU and flash modules are present. Fast blinking indicates BBU is charging. **Amber** steady on indicates CBM failure, meaning either BBU or flash has failed. When lit, it also indicates either BBU or a flash is missing in a redundant-controller system. **Blinking** means a BBU is being charged. **OFF** means BBU is not installed in a single-controller “G” model.
Hst Bsy	Green	**Rapidly Blinking** to indicate traffic on the host bus.
Drv Bsy	Green	**Rapidly Blinking** to indicate traffic on the drive channels.
Restore	Green	**Lit Green** to indicate the RAID configuration default has been successfully restored. The LED state will be

Default		invalidated after a few seconds. See below for how to use the push button.

Table 4-3: Controller LED Definitions

How to Use the Restore Default Button?

CAUTION!

The Restore NVRAM Default push button should be considered as a last-resort function. Although restoring firmware defaults will not destroy the existing logical drives; however, detailed configurations, such as various parameters and host LUN mappings, will be erased.

There is a non-latch type push button accessed through an opening on the controller faceplate.

Why restoring defaults?

1. Some of the latest firmware updates may be incompatible with the firmware currently running on your system. These updates may require restoring firmware defaults before firmware upgrade can actually take place. Before using the button, it is highly advised to practice the following:

   - Stop host I/Os,
   - Save NVRAM, (you can save NVRAM contents either on a terminal console, Embedded RAIDWatch, or using the SANWatch software)
   - Make a list of host ID/LUN mapping information for future references.

   You may also jot down the configuration parameters such as the performance preferences, specific stripe sizes, etc.

2. Firmware has an embedded 1GB threshold for internal settings such as the supported no. of logical drives. When you upgrade controller DIMM module, say, from 512MB to 2GB, you need to restore firmware defaults after you upgrade your DIMM module size to 2GB.

3. Another condition that requires restoring defaults is when a system administrator forgets the password controlling the access to a RAID system. Before pushing this button, also practice the steps listed above. You can access configuration screen and manually record array information even without a password.

Listed below are the necessary procedures that should be completed before using this button:

1. Before pressing this button to restore firmware defaults, it is highly advised to save your current configuration using the "**Save NVRAM**" function in firmware utility or the SANWatch GUI.
2. You may also make a list of the existing ID/LUN mapping information. You will need the list for restoring ID/LUN mapping after restoring defaults. Default restoration will erase the ID/LUN mapping associations (e.g., which logical drive is associated with which host ID/LUN), and it will be necessary to restore the previous settings using the "**Restore NVRAM from Disks**" or "**Restore NVRAM from Files**" functions. Configurations such as ID/LUN mapping will be restored after a system reset.

How to use the button?

Single-controller system:

After the system is powered down, you can use a straighten paper clip to press the button. Press and hold the button down, power on the system, and wait for the associated LED and the system **Ready** LED to light up. The "**Restore Def.**" LED and the firmware "**Default Restored**" event message will indicate a successful restoration of firmware defaults.

Redundant-controller:

With redundant RAID controllers, the procedure can be more complicated:

Step 1. Remove controller B from the subsystem, power down, and then power on with the "Restore Def." button depressed to restore the firmware defaults on the remaining controller.

Step 2. When the "**Restore Def.**" LED is lit and the "default restored" firmware event appears on the LCD screen, release the button. You may ask your colleague to observe the message on the other end of the chassis to see if the "default restored" event appears.

Step 3. Power down, install controller B to the controller A slot, and repeat the restoration process.

Step 4. When completed with restoring defaults on both controllers, install both controllers and power on.

4.2.4 FC Host Port LEDs

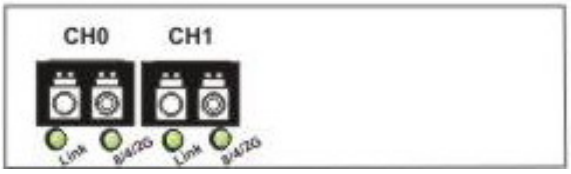


Figure 4-4: FC Port Link and Speed LEDs

Name	Color	Status
Link	Green	**ON** indicates an established link, Off means a link is broken.
8/4/2G	Green/ Amber	**Green** indicates 8G connection. **Amber** indicates 4G connection. **OFF** indicates 2G speed or no connection.

Table 4-4: 8G FC Port LED Definitions

4.2.5 Ethernet Port LEDs

One (1) 10/1 00BaseT Eth ernet port is located on e ach controller's faceplate. Sh ielded Cat5e strai ght-through Ethe rnet cab les can be used to con nect the RJ-45 port s to the netwo rk. Two (2) LE Ds located on each Ethernet port indicate the Ethernet connection speed and link status. See the diagram below for the locations of the two (2) LED indicators.

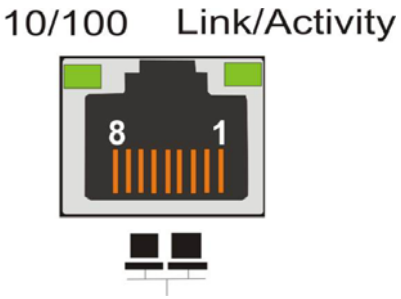


Figure 4-5: 10/100BaseT Management Port Indicators

Name	Color	Status
10/100	Green	**ON** indicates a valid link of the 100Mbit speed. **OFF** indicates a link with 10Mbit speed.
Link/Activity	Green	**ON** indicates a valid link. **BLINKING** indicates active transmission.

Table 4-5: 10/100BaseT Management Port LED Definitions

4.2.6 PSU LEDs

Each PSU comes with a single LED. This LED indicates the operational status of the PSU module.

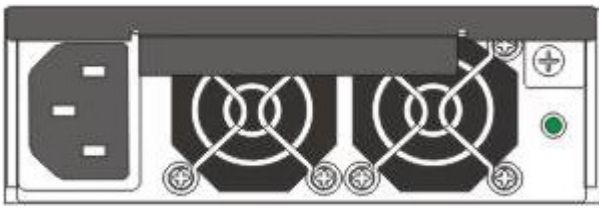


Figure 4-6: PSU Module LED

Color	Status
Steadily Blinking Green	The power supply has not been turned on. The PSU module LED will blink when the system is connected to a power source but not yet turned on.
Static Green	The PSU is operating normally and experiencing no problem.
Static Red	The PSU has failed and is unable to provide power to the system.
OFF	The PSU is not turned on and the power cord is disconnected.

Table 4-6: PSU Module LED Definitions

4.2.7 Cooling Module LEDs

Each individual cooling fan within a cooling module has a corresponding red LED on the system rear panel. When an LED is on, it indicates the fan has failed. When the LED is off, it indicates the fan is functioning normally.

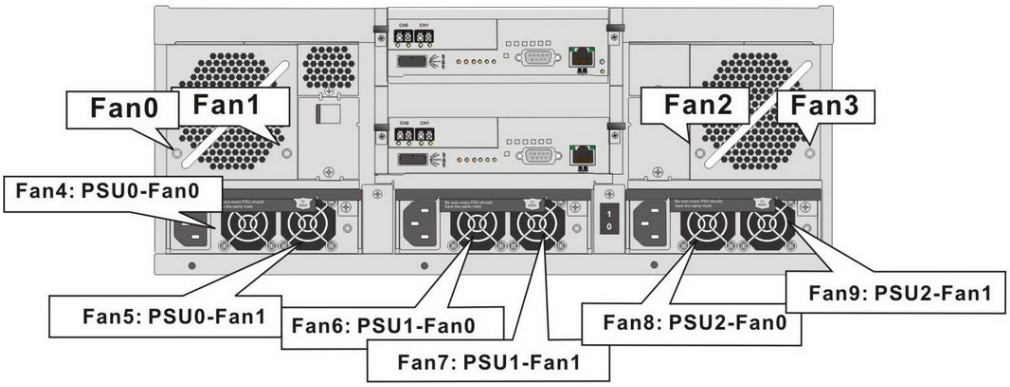


Figure 4-7: Cooling Module LEDs and Cooling Fan Locations

The system has a novel approach to stabilizing the temperature within the subsystem: When sensors on the backplane detect

elevated temperature, such as high ambient temperature or the failure of any cooling or PSU module, the system will raise the cooling fans rotation speed to extract more heat. Once the ambient temperature cools down to normal or the failed modules have been replaced, the cooling fans will return to low speed.

A faulty fan is not individually replaced. Due to the concern that system may overheat during a single fan replacement process, if a fan fails, replace the whole module.

4.3 Audible Alarm

Different environmental and operational parameters (like temperature, etc.) have been assigned a range of values between which they can fluctuate. If either the upper or lower threshold is exceeded, an audible alarm will be triggered. The alarm will also be triggered when a component fails. If the system administrator is onsite and hears an alarm, the manager must read the error message on the terminal or SANWatch screen to determine what has triggered the alarm. After determining what has occurred, a system administrator must take appropriate actions to rectify the problem.

The Alarm beep pattern is described in the Troubleshooting Guide included in your product CD.

WARNING!

If an alarm is triggered it is necessary for you to determine the problem. If the audible alarm is ignored and the problem is not rectified, unexpected damages may occur.

4.3.1 Alarm Triggers

If any of the following components fails, the audible alarm will be triggered:

- RAID controller module (in a redundant-controller configuration)
- Cooling fan modules
- PSU modules
- CBM module
- Hard disk drives
- Sensors or presence detection circuitries

NOTE:

When temperature exceeds a preset threshold, the controller's charger circuits will stop charging. You will then receive a message that reads "Thermal Shutdown/Enter Sleep Mode." When the temperature falls back within normal range, the battery will resume charging.

4.4 I2C

The operating status of PSU and cooling fan modules are collected through an I^2C serial bus. If either of these modules fails, the failure will be detected and you will be notified through the various methods described above. If sensors or I2C bus devices fail, events will also be issued.

Chapter 5

System Maintenance

5.1. Overview

5.1.1 Maintenance

WARNING!

Do not remove a failed component from the sub system until you have a replacement on hand. If you remove a failed component without replacing it, the internal airflow will be disrupted and the system will overheat.

CAUTION!

1. Do not insert a controller module from other Falcon IV enclosures, e.g., a controller module from an S16F. A controller from other enclosure may have acquired a system serial number from it, and could have used the serial number to generate a unique controller ID. The unique ID is consequentially applied to FC port node names. As the result, you may encounter SAN problems with identical port names on multiple systems.
2. Do not use a PSU or cooling module from Falcon IV series. They look similar. However, they may come with cooling fans with different rotation speeds, and may not be sufficient for your G6 (ASIC667) models.

All of the following components can be replaced in case of failure:

1. Controller module – **Section 5.2**
2. Memory module – **Section 5.3**
3. BBU module - **Section 5.4**
4. PSU modules – **Section 5.5**
5. Cooling fan modules – **Section 5.6**
6. Hard drives – **Section 5.7**

5.1.2 General Notes on Component Replacement

- In a redundant-controller configuration, a RAID controller is hot-replaceable. In a single-controller configuration, a RAID controller is

replaced when powered down. All other component modules, including the PSU modules, cooling modules, and drive trays, are hot-swappable and can be replaced while the system is operating.

- Qualified engineers who are familiar with the system should be the only ones who make component replacements. If you are not familiar with the system and/or with RAID system maintenance in general, it is strongly advised that you refer system maintenance to a suitably qualified engineer.

- When replacing hot-swappable component, caution should be taken to ensure that the components are handled in an appropriate manner. Rough or improper handling of components can lead to irreparable damage.

- If removing a RAID controller from a single-controller system, ensure that your applications have been properly closed, users notified of the down time, all cached writes conducted, etc. All precautionary measures, without exception, are adhered to.

WARNING!

When inserting a removable module, take heed that **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the connector pins either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more force to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

5.2. Replacing a Controller Module

5.2.1 Overview

Two replaceable components are contained in a controller module:

- DIMM Module: The DIMM module can be replaced when a DIMM module fails or if a larger capacity DIMM is required.
- CBM: As part of the CBM module, a BBU within is usually replaced every 3 years. If a BBU has lost its ability to hold electric charge, replace it with a certified module.

WARNING!

1. The battery cells are not hot-swappable. The cell pack, BBU, is contained in a RAID controller canister. To replace a BBU, you must remove a RAID controller. It is recommended to remove the BBU before replacing a DIMM module because once a controller is removed from chassis, BBU will discharge to support the cache memory. If you replace a DIMM module with supplied voltage, damage may occur.
2. If necessary, replace a DIMM **1 minute** after the BBU is removed.

5.2.2 Notes on Controller Maintenance

- Re-using the DIMM module removed from a faulty controller is not recommended unless you have a similar RAID system to test its integrity.
- When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the system. All previously stipulated safety precautions (see **Chapter 2**) must be strictly adhered to. Failure to adhere to these precautions can result in permanent damage and timely delays.

5.2.3 Removing the Controller Module

To remove the controller module:

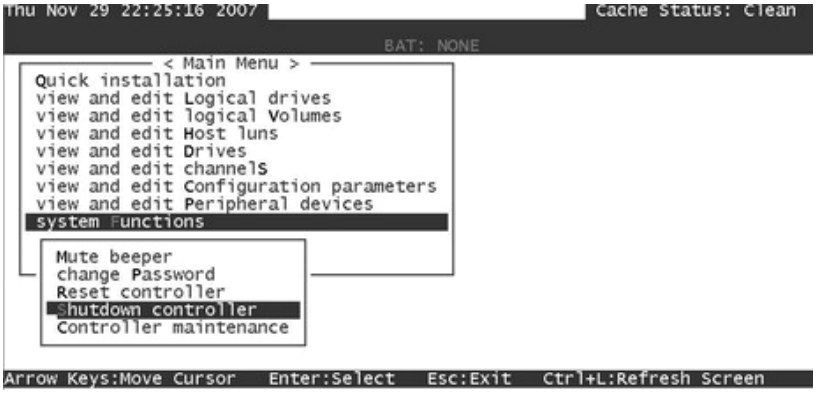
Step 1. Prepare a clean, static-free work pad or container to place the controller that will be removed from the chassis.

(Step 2 and Step 3 are for the single-controller system. Skip them if you are replacing a controller in the dual-controller Falcon IV)

Step 2. **Make sure there is no access from host computers to the system to avoid losing data**. Stop all I/O accesses to the system and make sure all cached writes have been distributed

to disk drives using firmware's "**Shutdown Controller**" function.

This function is accessed from **Main Menu** -> "**System Functions**."



Step 3. **Power off the system (For single-controller system only!)**. Power off the system in the way described in **Chapter 4**. Be sure to stop host access and flush all cached data before powering off the system. If it is not possible to do this **turn off** both PSU modules and disconnect the power cords.

Step 4. **Disconnect all cables** that are connected to the controller module you wish to replace.

Step 5. **Loosen the retention screws from controller**. Use a medium-size Phillips screwdriver to remove the screws underneath each of the ejection levers. Keep the screws for future use.

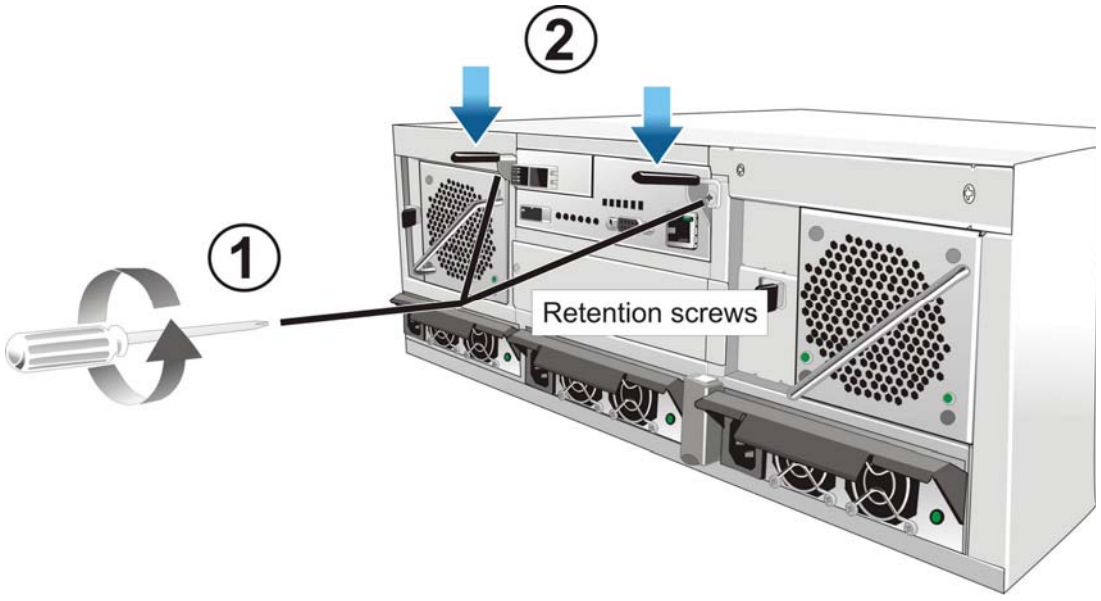


Figure 5-1: Loosening Controller Retention Screws

Step 6. **Remove the controller module** by pressing down the two ejection levers. The controller will be eased out of the module

bay. Gently pull the controller module out of the system with one hand underneath to support the weight of the module.

5.2.4 Replacing a Controller Module

If a controller module fails, replace a failed controller with a replacement from your vendor:

Step 1. **Remove the failed controller**. (See **Section 5.2.3**)

Step 2. **Install a DIMM module on the replacement controller, if it does not come with a DIMM**. (See **Section 5.3**)

Step 3. **Insert the controller module**. Align the controller module with the module bay, making sure that the levers are down. Gently slide the controller module in.

Step 4. **Secure the connection.** When the controller is reaching the end and you feel the contact resistance, use slightly more force to mate the controller with backplane connectors. When the controller is almost fully inserted, pull the levels up to secure the controller. The levers help ensure that the back-end connectors are properly mated.

Step 5. **Fasten the retention screws**. Once fully inserted, secure the controller module to the chassis by fastening the retention screws through the holes underneath the ejection levers.

Step 6. **Re-attach all the cables** that you previously disconnected.

Step 7. 7-1. **Power up** the system if using a single-controller system.

7-2. With a redundant-controller system, RAID controllers should spend a short while negotiating with each other and then deliver a "**Redundant Controller Restored**" message.

You can check for this message on the LCD screen, GUI manager, or firmware text-based utility. When the replacement controller is successfully brought online, its Controller Status LED should light green on its faceplate.

5.3. Replacing or Upgrading Memory Modules

5.3.1 Memory Module Installation Overview

- The system comes with a pre-installed 1GB (or above) DDR-II DIMM module. The controller supports a memory module up to 2GB in size. If

you need a larger DDR-II module or the original DIMM module malfunctions in some way (often shown as the "NVRAM failure" event), the pre-installed module can be replaced. Replacement and installation instructions are described below.

- A DIMM socket is located on the controller main circuit board.

WARNING!

The controller board in the controller module is a sensitive item. Please ensure that all anti-static precautions stipulated above are strictly adhered to.

5.3.2 Selecting the Memory Modules

Compatibility: To avoid the compatibility issues, it is recommended to contact RAID, Inc or your system vendor for a compatible module. We provide tested modules from reliable vendors with reliable chips.

5.3.3 DIMM Module Installation

Step 1. Use of an ESD grounding strap is highly recommended.

Step 2. **Remove the controller module**. (See previous section for details).

Step 3. **Remove the BBU module**, if installed. A BBU is removed by loosening its captive screw from the charger board. Using a medium-size Phillips screwdriver to do that.

Carefully place the module for it contains Li-ion batteries. Do not drop it to the floor or place it near any heat source.

Step 4. **Wait for one minute** for the remaining electricity on main board to disperse. **Remove the faulty module from the DIMM socket**. To do this, push the white module clips on either side of the DIMM socket down. The DIMM will be ejected from the DIMM socket.

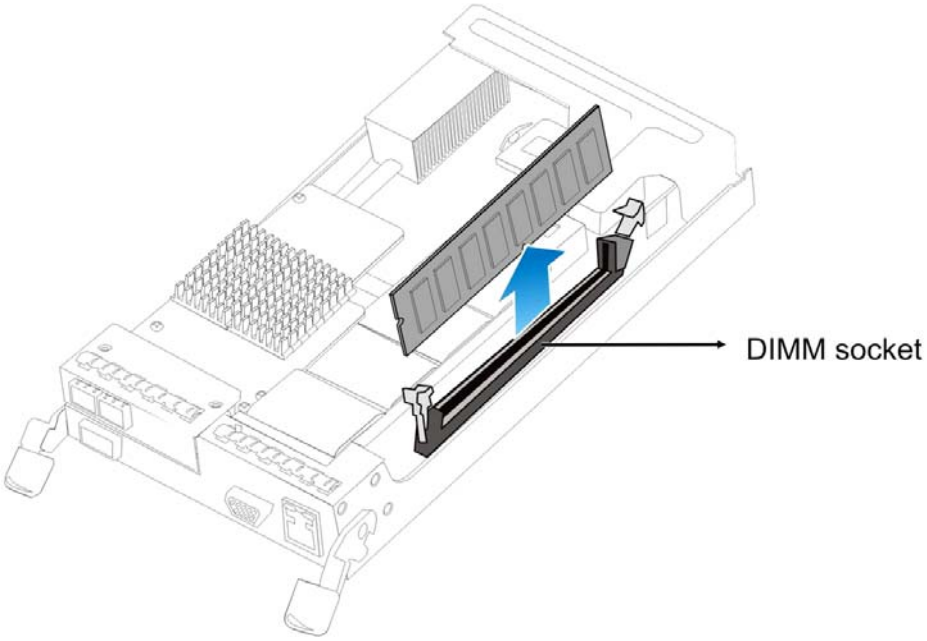


Figure 5-2: Removing a DIMM Module

Step 5. **Insert the replacement module into the DIMM socket**. Make sure the white clips of the DIMM socket are in the open positions. Align the DIMM module with the DIMM socket by checking its "keyed" position. Once aligned, gently and firmly push the DIMM module into the socket. The white clips on the sides of the socket will close automatically and secure the DIMM module into the socket.

Step 6. **Reinstall the BBU module.**

Step 7. **Reinstall the controller module**. After the DIMM module has been properly installed, install the RAID controller.

7-1. To do this, align the controller module with the module bay. Then gently push the controller module into the controller bay.

7-2. Carefully push the controller until you feel the contact resistance when the board edge connectors are engaging the backplane connectors. Do not use force. If unusual contact resistance is felt, try it again.

7-3. Use the ejection levers to secure it to the chassis when the controller is almost fully inserted.

7-4. When the controller is inserted with the levers at its lowest position, notches on the levers should properly clinch to the round anchor pins on the interior walls of module bay. You may then pull the lever upward to mate the back-end connectors.

7-5. Secure the controller module to the chassis by fastening the screws through holes underneath each ejection lever.

5.4. Replacing a Faulty CBM

The CBM module can sustain and transfer cached data to a flash module in the event of a power outage or in the unlikely event of failing both PSUs.

A BBU consists of a metal bracket, battery cell pack, and a PCB board that connects to the charger board. BBU supplies power during data transition from cache memory to flash. Please read the BBU handling precautions below before handling BBUs.

Fault Conditions:

A BBU failure can result from the following:

1. A BBU has lost its ability to hold electrical charge. This may be the case after the battery cells have been recharged for many times regardless of how long the module has been used. Therefore, a stable power source is important for system operation.

2. The charger circuitry implemented with the controller has failed.

There are other conditions that might trigger the BBU fault events and the BBU fault LED:

1. The temperature sensor on the system's charger circuit reports a temperature reading exceeding the preset threshold. The charger circuits will enter a low-power and self-protection state.

2. A BBU module has been charged for over twelve (12) hours. A timer is embedded with the charger. When this occurs, the charger will enter a timer fault state. This condition usually occurs with a brand new BBU or with a totally discharged BBU. Charging will resume automatically if you remove and re-install the BBU module.

5.4.1 BBU Warnings and Precautions

- Install or replace the BBU with BBUs supplied by your Falcon IV vendors only. Use of battery cells provided otherwise will void our warranty.

- Always dispose of a replaced battery in an ecologically responsible manner. Dispose of used BBUs at authorized battery disposal sites only.

- Do not place a BBU near a heat source. Heat can melt the insulation and damage other safety features of batte ry cells, possi bly will cause aci d leak and result in flames or explosion.

- Do not imme rse the BBU in water no r allow it to get wet. Its protectiv e features can be damag ed. Abnorm al chemi cal re actions may occur, possibly cause functional defects, acid leak, and other hazardous results.

- Do not di sassemble or m odify the BBU. If disasse mbled, the BBU co uld leak acid, overheat, emit smoke, burst and/or ignite.

- Do not pierce the BBU with a sharp object, strike it with a hamm er, step on it, or throw it. These a ctions co uld dama ge or d eform it and intern al short-circuiting ca n o ccur, possibly cause fun ctional defect s, aci d lea k, and other hazardous results.

- If a BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in a ny way appe ars abnormal during use, recharging or storage, immediately remove it from the system and stop using it. If this is discove red when you first use t he BBU, conta ct RAID, Inc o r yo ur system vendor for a replacement.

5.4.2 Replacing a Faulty BBU

To replace a BBU, please follow these steps:

Step 1. Remove controller as previously described.

Step 2. **Remove the faulty BBU from the chassis**. Loosen the captive screw at the end of BBU module.

Step 3. 3-1. Install the repl acement module b y orienting its protruding edge on one side into the in sertion slot, and lowering it towards the charger board.

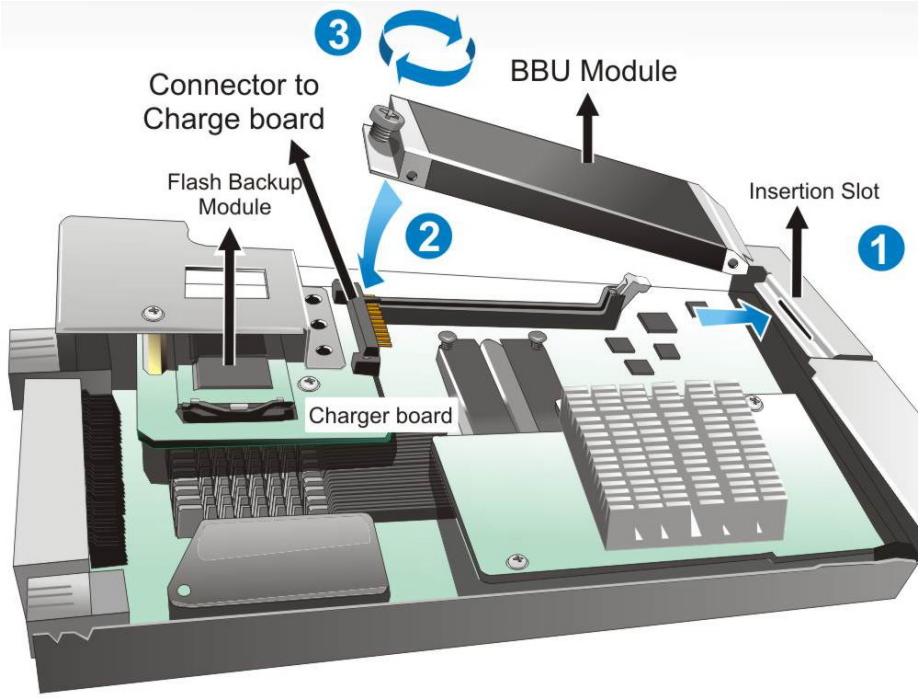


Figure 5-3: Installing BBU into a Controller

3-2. Carefully align the BBU connector with that on the charger board. Press the BBU down to mate the connectors.

3-3. Secure the BBU by fastening its captive screw.

Step 4. **Re-install the controller.**

Step 5. **Reset the system.** Find appropriate time to reset the system for the system firmware to recognize the replacement module. After a reset, the BBU LED will start flashing to indicate that the BBU is being charged. When the BBU is fully charged, the LED will be off.

NOTE:

1. A replacement BBU takes approximately twelve (12) hours to charge to its full capacity. Reset the system whenever a BBU is replaced or added in order for the replacement module to take effect.
2. The life expectancy of a BBU is 3 years. Follow the procedures above to replace a used BBU in order to maintain the fault tolerance feature.
3. The chance of BBU charger failure is comparatively low. If the cause of a failure cannot be determined even after a BBU module is replaced, contact your system vendor for a replacement controller and return the controller through RAID, Inc's standard RMA procedure.

5.4.3 Replacing a Faulty Flash

To replace a flash module, please follow these steps:

Step 1. Remove controller as previously described.

Step 2. **Remove the faulty flash from the charger board** using the index fingers from both hands to pull the retention clips away from the flash card. If the flash card does not easily disengage, use your finger nails to pick it up. Once released, the flash card will pop up. You can then remove it from the socket.

Step 3. Insert a replacement flash in to the socket by a 15 degree angle. When fully inserted, press the flash card down until it is snapped by the retention clips.

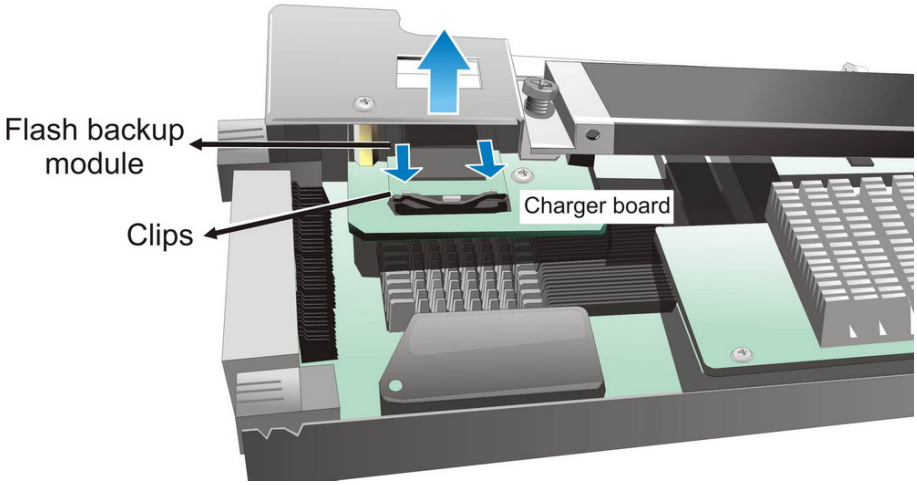


Figure 5-4: Installing Flash Card

5.5. Replacing a Faulty PSU

5.5.1 Notes on PSU Module Maintenance

- **Redundant, load-sharing PSU modules**: The system comes with two fully redundant, hot-swappable PSU modules.
- **PSU canister**: Each PSU module is housed in a robust steel canister, with the power supply converter unit in the front and two cooling fans in the rear section.
- **Immediate replacement**: When a PSU fails, it should ideally be replaced immediately. Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement will cause severe disruptions to the internal airflow and the system will overheat, possibly causing irreparable damage to some of the system components.

WARNING!

Although the system can operate with two PSUs, it is not advisable to run the Falcon IV system with a failed PSU for an extended period of time.

Power Supply Fault Conditions & Firmware Reactions

No. of Failed PSUs	Responses and Preventive Actions
1	1. Warning messages are issued. 2. Cached data is flushed to the hard drives (also depends on the Event Triggered configuration settings in firmware). 3. If previously configured to the Write-back mode, the caching mode is automatically switched to the conservative Write-through mode.
2	1. Warning messages are issued. 2. The system is temporarily held in an idle state. 3. The firmware forces the sub system to stop servicing host I/O requests. 4. After the failed PSUs are replaced, array administrators should manually turn the power switch off and then on. 5. If the system is powered on with only one PSU, the firmware will start the initialization process but stays idle until at least one other PSU is added.

Table 5-1: Power Supply Fault Conditions & Firmware Reactions

5.5.2 Replacing the PSU Module

To replace a PSU, please follow these steps:

Step 1. **Power off the PSU**. The power switch is located on each PSU's rear-facing panel. (See **Figure 5-5**)

Step 2. **Disconnect the power cord** that connects the PSU to the power source.

Step 3. **Loosen the retention screw** that secures the extraction handle to the chassis using a Phillips screwdriver. See below drawing for its location.

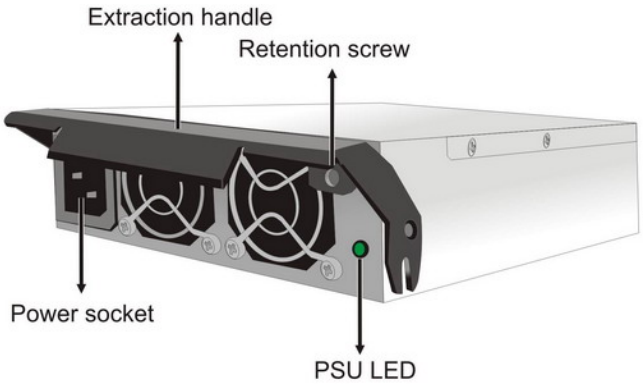


Figure 5-5: PSU Parts Identification

Step 4. **Remove the PSU module** by pushing the extraction handle downwards. The extraction handle should gracefully disconnect the PSU from the backplane connectors. Once dislodged, gently pull the PSU module out of the system. If the system is mounted in a rackmount rack, use another hand to support its weight while removing the module. (See **Figure 5-6**)

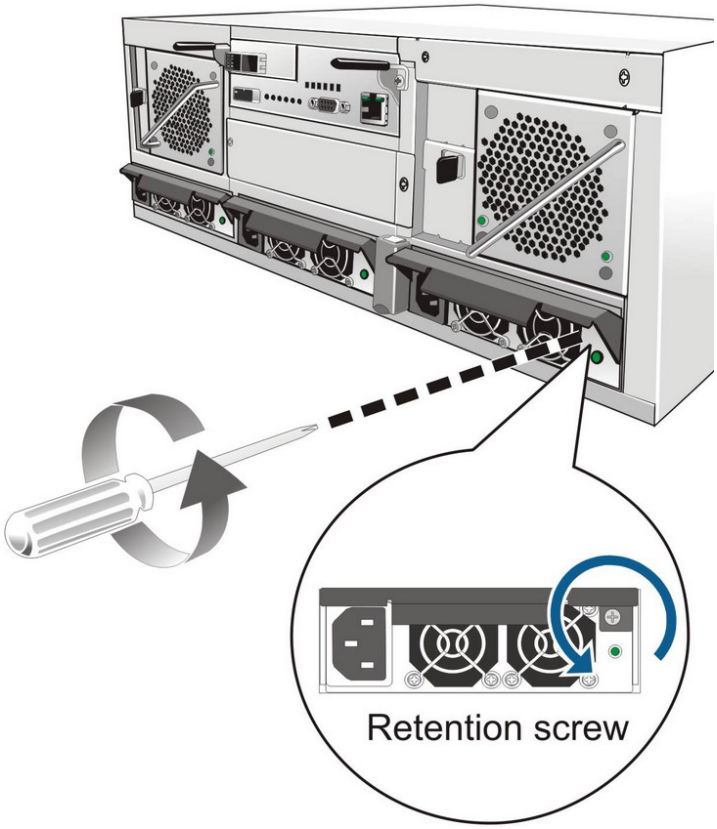


Figure 5-6: Removing the PSU Module

WARNING!

It is recommended that the replacement procedure is completed in less than five (5) minutes to prevent a prolonged disruption to system airflow.

Step 5. **Install the replacement module**. Make sure the extraction handle is held at its lowest position so that the saddle notches on the sides of the handle can snap onto the metal anchor pins on the interior walls of the PSU slot. Push the PSU into chassis, and when you feel the contact resistance, pull the handle upwards to secure the module.

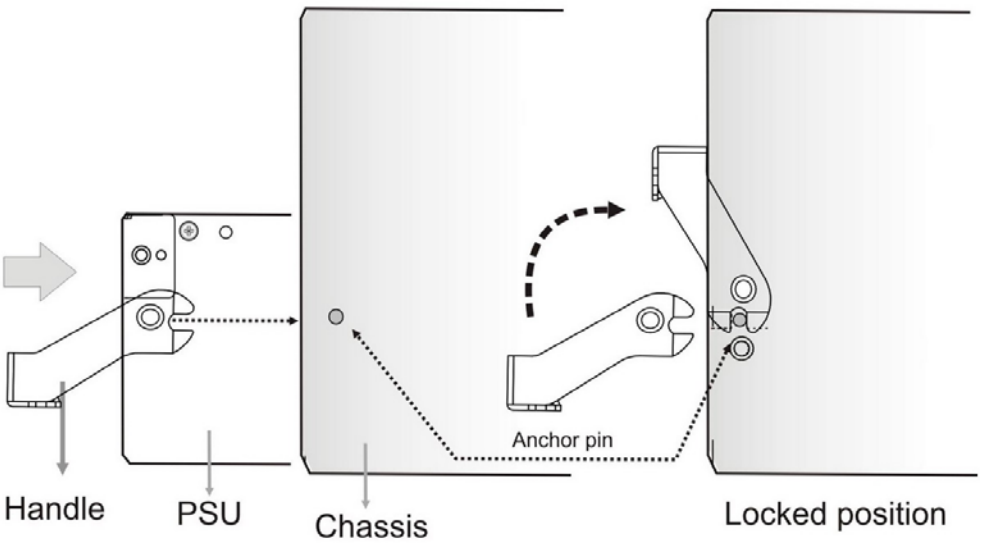


Figure 5-7: Securing PSU Using the Extraction Handle

Step 6. **Secure the PSU to the system** by fastening the retention screw through the PSU extraction handle.

Step 7. **Replace the power cord** that connects the PSU module to the mains.

Step 8. **Secure the power cord connection** using the included cable clamp.

Step 9. **Power on the PSU module.**

5.6. Cooling Module Maintenance

5.6.1 Notes on Cooling Module Maintenance

- **Detecting a failed cooling module:** If a cooling module fails, system firmware and SANWatch manager will deliver warning events. The LEDs located on the cooling module will light red and an audible alarm will be triggered.
- **Airflow Concern:** Once you are notified that a cooling module has failed, it should be replaced as soon as possible. A failed module should

only be removed from the system when you have a replacement module immediately available.

5.6.2 Replacing a Cooling Module

The cooling module is secured in the chassis by a retention latch. To replace the cooling module, follow the steps below:

WARNING!

The fan replacement process should be completed within five (5) minutes. If the process takes too long, the accumulated heat can damage the system.

Step 1. Use one hand to push the retention latch to the side, while using another hand to hold and pull on the fan module handle.

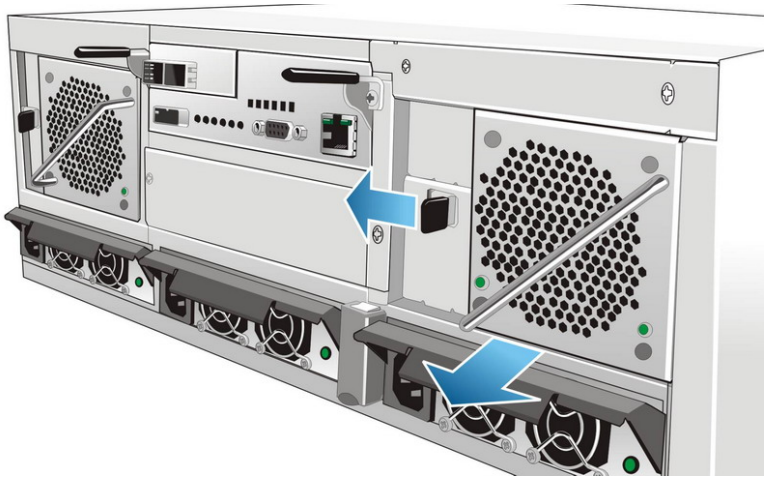


Figure 5-8: Removing a Cooling Module

Step 2. Once released from the module bay, remove the faulty module.

Step 3. **Install the replacement module** by pushing it gently into the module bay. You may need to flip the retention latch while installing the replacement module. When fully inserted, the retention latch will hold the module in place.

5.7. Replacing a Hard Drive

5.7.1 Hard Drive Maintenance Overview

- **Hot-swappable drive trays:** The drive trays are all hot-swappable. A disk drive failure can be corrected online.

- **Handles:** If a faulty drive is behind either the left- or right-side front handle, unfold the handles to access to the drive trays.

CAUTION!

Failure to remove a healthy drive from the system after the front bezel has been opened can cause insecure connection and data errors.

- **Slow and careful removal:** When removing a drive tray from the system, **pull the drive tray out only about one inch and then wait for at least 30 seconds for the hard drive motor to spin down before taking it out completely**. Any impact to the hard drive while the drive motor is spinning can damage the hard drive.

  There are situations that healthy drives can be removed. In operations such as Copying & Replacing member drives with drives of larger capacity, you may need the replaced disk drives in other installations.

5.7.2 Replacing a Hard Drive

To replace a hard drive, please follow these steps:

WARNING!

Hard drives are fragile; therefore, always handle them with extreme care.

- Do not drop the hard drive.
- Always be slow, gentle, and careful when handling a hard drive.
- Handle a hard drive only by the edges of its metal cover, and avoid touching its circuits board and interface connectors.

Step 1. **Identify the location of the drive tray** that contains a hard drive indicated as faulty. You may use firmware utility or SANWatch software to locate a faulty drive. The drive tray LED should also light red.

WARNING!

Removing the wrong drive can destroy a logical drive. A RAID5 logical drive tolerates the failure of 1 member. If you replace the wrong drive while a

logical drive already has a faulty member, you risk the chance of data loss.

Step 2. Use a 1/8" flatblade scre wdriver to turn **the rotary bezel lock to the unlocked position**, i.e., the groove on its face is in a horizontal orientation.

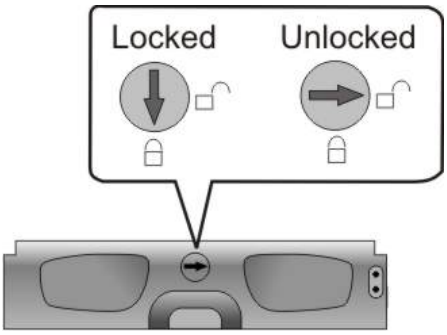


Figure 5-9: Opening the Front Flap

Step 3. **Open the tray bezel** by pushing the release button. The fro nt bezel will automatically swing open.

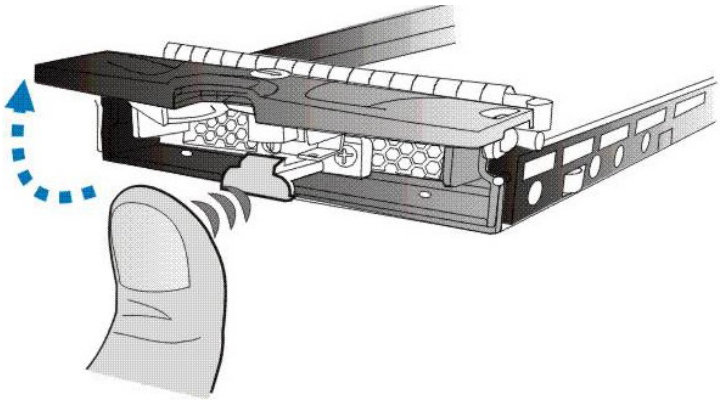


Figure 5-10: Opening Front Bezel

Step 4. **Remove the drive tray by pulling it one inch away from the drive bay. Wait for at least 30 seconds for the disk drive to spin down (if the disk drive is removed for a different purpose, e.g., Drive Roaming or cloning members of a logical drive),** and then gently and carefully withdraw the drive tray from the chassis.

Step 5. **Remove the four (4) retention screws** that secu re the ha rd drive from the sides of the drive tray (two on each side.)

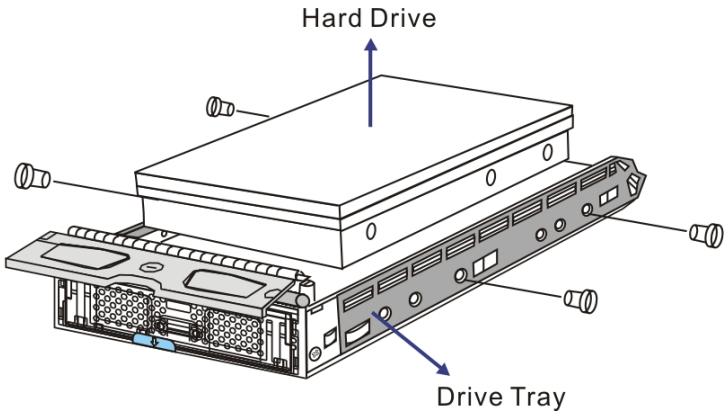


Figure 5-11: Loosening Hard Drive Screws

Step 6. **Place the replacement drive into the drive tray** (as shown below), making sure that the interface connector is facing the open side of the drive tray, and the label side facing up.

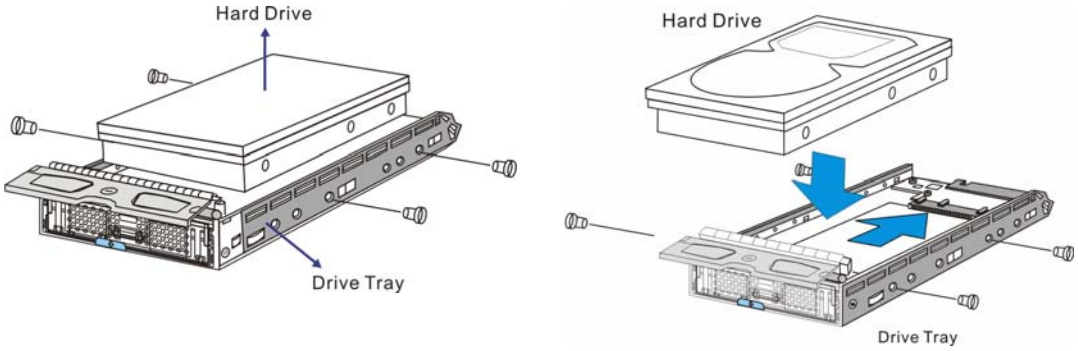


Figure 5-12: Installing a Hard Drive

Step 7. **Adjust the drive's location** until the mounting holes in the drive canister are aligned with those on the hard drive. Screw holes used are different if using a MUX board for SATA drives. MUX boards are only necessary using SATA drives in a redundant-controller configuration.

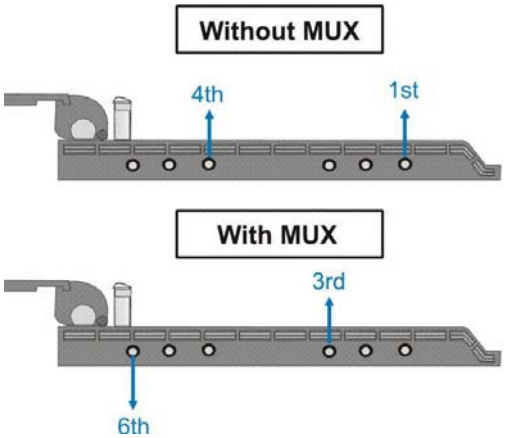


Figure 5-13: Drive Locations with and without the MUX Board

Step 8. Secure the disk drive with four (4) of the supplied 6/32 flat-head screws.

Step 9. **Align the drive tray with a drive bay**. Gently slide it in until the drive tray reach the end of drive bay. This should be done smoothly and gently.

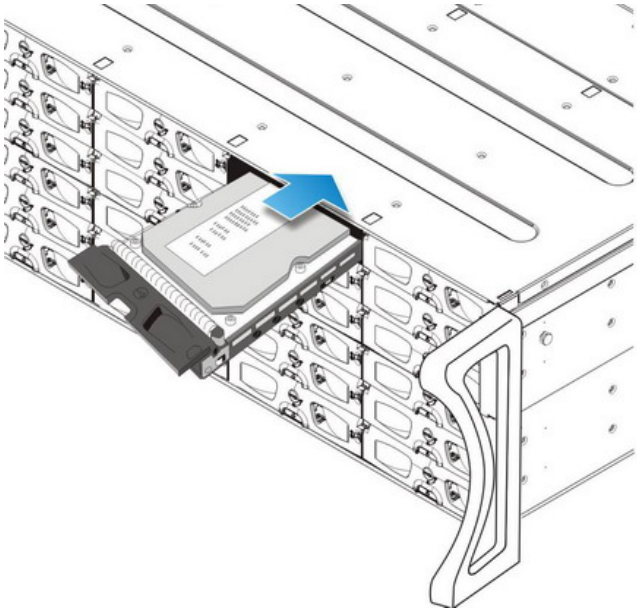


Figure 5-14: Installing a Drive Tray

Step 10. **Close the front bezel**. Make sure the front bezel is closed properly to ensure that the back-end connector is properly mated with the corresponding connector on the backplane. If the front bezel can not closed properly, the connection between the hard drive and the system may come loose and mysterious drive signals may result.

Step 11. **Lock the bezel into place** by turning the rotary bezel lock until the groove on its face is pointing down (vertical orientation).

Step 12. The drive Busy LED should light up after a few seconds meaning the system is attempting access. If the replaced drive belonged to a logical drive with fault tolerance, e.g., RAID levels 1, 3, 5, or 6, a logical drive rebuild will automatically begin. You should then verify the beginning of the rebuild process using management software or terminal console. A firmware message, “Rebuilding LDX,” should also pop up on the LCD screen.

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Appendix A

Specifications

A.1. Technical Specifications

Environmental Specifications	
Humidity	5 to 95% (non condensing – operating and non-operating)
Temperature	Operating: 0º to 40ºC (35ºC if CBM is applied) Non-operating: -40º to 60ºC
Altitude	Operating: Sea level to 12,000ft Packaged: Sea level to 40,000ft

Power Requirements	
Input Voltage	100VAC @ 8A 240VAC @ 4A with PFC (auto-switching)
Frequency	50 to 60Hz
Power Consumption	434W busy; 408.9W idle.

Dimensions		
	With Forearm Handles	**Without Forearm Handles**
Height	174.4mm (6.86 inches)	174.4mm (6.86 inches)
Width	482mm (19 inches)	445mm (17.5 inches)
Length	514mm (20.2 inches)	498mm (19.6 inches)

Certifications
Safety UL (60950-1 2'nd) BSMI CNS 14336: 1993 CB IEC 60950-1, 2'nd Edition GOST-R GOST60950 **EMC** CE EN 55022: 2006/A1:2007 EN 61000-3-2: 2006 EN 61000-3-3: 1995/A1: 2001 /A2: 2005 EN 55024: 1998/A1: 2001/A2: 2003 FCC (FCC Part 15, subpart B) BSMI (CNS 13438) FCC (FCC Part 15,subpart B) **Certificates** • IEC 60068-2, • MIL-STD-81 0E/883E, • ISTA, • ASTM-D3332 , • IPC-TM -650 • IEC 61000-4 • IEC 61000-3-2, IEC61000-3-3 • ISO7779/37 44 • Ro HS Microsfot WHQL-WindowsServer 2003

Shock	
Half-sine	Operating: 5G peak, 11ms duration Non-operating: 15G, 11ms duration

Vibration	
Operating	0.5oct/min, 5 to 500Hz, sinewave, 0.2G
Non-operating	0.5oct/min, 5 to 500Hz, sinewave, 1.0G

- Various tests have been conducted according to industry standards. Please contact your sale s rep resentatives or visit ou r VIProom website fo r individual test reports.

Warning Alarms
• Audible alarms • System LEDs • Event notification via the SANWatch Manager (LAN broadcast, email, fax, MSN, SMS, and SNMP traps) • RS-232C terminal console • LCD event prompts • Telnet console

A.2. Controller Specifications

A.2.1 Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 6, 10, 30, 50, 60, and non-RAID disk spanning
Host O/S Compatibility	Host O/S independent
Host Interface	8Gb/s Fibre Channel
Host Channels	2 pre-configured host channels (each controller)
Drive Interface	Supports up to 16 channels of 3Gbps SAS or SATA-II
Drive Channels	All drive channels are pre-configured and cannot be changed
Cache Mode	Write-through, write-back, and adaptive write policy
Cache Memory	Pre-installed 1GB (or above) DDR-II module with ECC, registered; in one DIMM socket
Number of LUN's	Up to 32 per host ID, for a total of 1024 on all host channels
Multiple Target IDs/Host Channel	Yes
Firmware on Flash Memory	Yes

A.2.2 Architecture

Specification	
CPU	2x RISC-based CPUs
Host Channel Chip Controllers	PMC chipsets
DIMM Slot	For one 240-pin DDR-II SDRAM module

ASIC	RAID, Inc ASIC667 64-bit chipset
Flash ROM	64Mbit (8MB)
NVRAM	32KB with RTC (with the Embedded RAIDWatch utility)
Hardware XOR	Yes
Real-time Clock	For event messages with time record and task scheduling

A.3. Power Supply Specifications

Specification	
Nominal Power	405W
DC Output	+3.3V: 3.20V to 3.465V; max. 20A +5V: 4.80V to 5.25V; max. 36A +12V: 11.52V to 12.60V; max. 24A +5V SB: 4.85V to 5.25V; max. 0.5A +3.3V & +5V combined power; max. 205W
Input Frequency	50 to 60Hz
AC Input	100VAC @ 8A – 240VAC @ 4A with PFC
Power Factor Correction	Yes
Hold-up Time	At least 20ms at 115/230VAC full load after a loss of AC input
I^2C	Links to presence detection circuitry and sensors through backplane to controller
Over-temperature Protection	Lost cooling or excessive ambient temperature
Cooling Fans	Two fans inside each PSU

A.4. RAID Management

Specification	
Configuration	• Text-based firmware-embedded utility over RS-232C through a DB-9 male to DB-9 female serial cable • LCD keypad panel • The SANWatch Manager program using the management port (10/100BaseT) or in-band connection • Embedded RAIDWatch via browser. • Text-based firmware-embedded utility via telnet
Performance Monitoring	Yes
Remote Control and Monitoring	Yes
Event Broadcast/Alert	Yes (via SANWatch sub-modules, the Notification Manager utility, or the firmware-embedded browser-based Embedded RAIDWatch)
Hardware Connection	over Ethernet, in-band via host links, or RS-232C

Configuration on Disk	Configuration data stored on disks for logical drives to exist after controller replacement; basic settings, e.g., channel mode settings, are stored on NVRAM. Applies to uses such as Drive Roaming with the support of Shutdown or Restart Logical Drive functions.
Failure Indicator	Via audible alarm, LCD keypad panel, SANWatch Manager session, event messages, or terminal emulation

A.5. Fault Tolerance Management

Specification	
Drive S.M.A.R.T. support	Yes, with user-configurable detect-only, clone-and-replace, and perpetual-clone options. The S.M.A.R.T. feature depends on HDD implementation.
CBM (Cache Backup Module)	Yes
Sensors and Module Presence detection through an I^2C serial bus.	Yes, reported to firmware
Automatic Drive Failure Detection	Yes
Automatic Rebuild on Spare Drives	Yes
Regenerate Logical Drive Parity	Yes
Bad Block Reassignment	Yes
Automatic Rebuild upon Failed Drive Replacement	Yes
Manual Clone of Suspected Failed Drive	Yes
Concurrent Rebuild on Multiple Drives in a RAID (0 + 1) or RAID6 Logical Drive	Yes
Event-triggered operation	Firmware applies conservative write-through operation in the event of module failures, and raises fan rotation speed.

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Appendix B

Pinouts

B.1 8Gb/s FC Port Pinouts

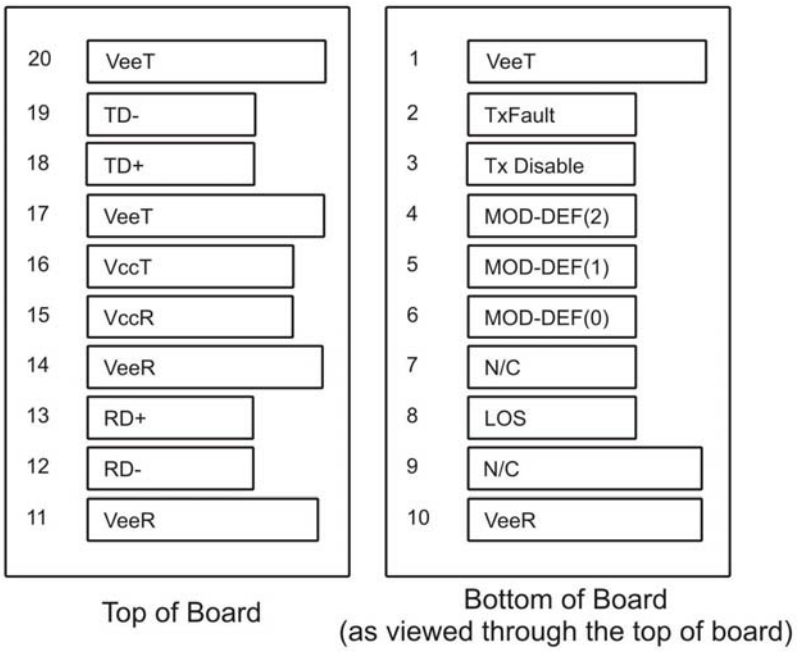

Figure B-1: 8G FC Host Port

Pin	Pin Name	Pin Description
1	V_{EET}	Transmitter ground
2	T_{FAULT}	Transmitter fault indication – High indicates a fault condition
3	T_{DIS}	Transmitter Disable – Module electrical input disables on high or open
4	MOD_DEF(2)	Module definition 2 – Two wire serial ID interface data line (SDA)
5	MOD_DEF(1)	Module definition 1 – Two wire serial ID interface clock line (SCL)
6	MOD_DEF(0)	Module definition 0 - Grounded in module (module present indicator)
7	No Connect	Internal pullup 30KΩ to Vcc
8	RX_LOS	Indicates loss of signal; High indicates loss of received optical signal
9	No Connect	Internal pullup 30KΩ to Vcc
10	V_{EER}	Receiver Ground
11	V_{EER}	Receiver Ground
12	RD-	Inverse Received DATA Out
13	RD+	Received Data Out
14	V_{EER}	Receiver ground
15	V_{CCR}	Receiver power +3.3V
16	V_{CCT}	Transmitter power +3.3V
17	V_{EET}	Transmitter ground
18	TD+	Transmitter DATA In
19	TD-	Inverse Transmitter Data In
20	V_{EET}	Transmitter Ground

Table B-1: SFP Port Pinout Definitions

B.2 10/100BaseT Ethernet Port Pinouts (Management Port)

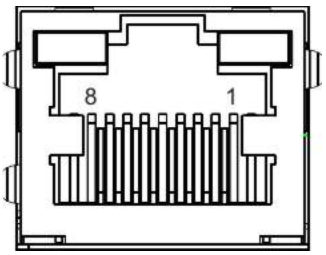

Figure B-2: 10/100BaseT Ethernet Port

Pin	Pin Name	Color Match
1	LAN_TXP	Orange
2	LAN_TXN	Orange/white
3	LAN_RXP	Green
4	N2	Blue/white
5	N2	Blue
6	LAN_RXN	Green/white
7	N1	Brown
8	N1	Brown/white

Table B-2: 10/100BaseT Ethernet Port Pinouts

B.3 STP Ethernet Cable (Optional Accessory)

P/N: IFT-9273CSTPCab-0030

This shielded twisted pair cable is an optional accessory item. More details are shown below:

Description: SFTP CAT5E Ethernet cable.
Color: black.
Connector: 8P8C plug (covered by metal shield)
Cable type: round cable, #24AWG*4P braided wire OD: 6.2mm

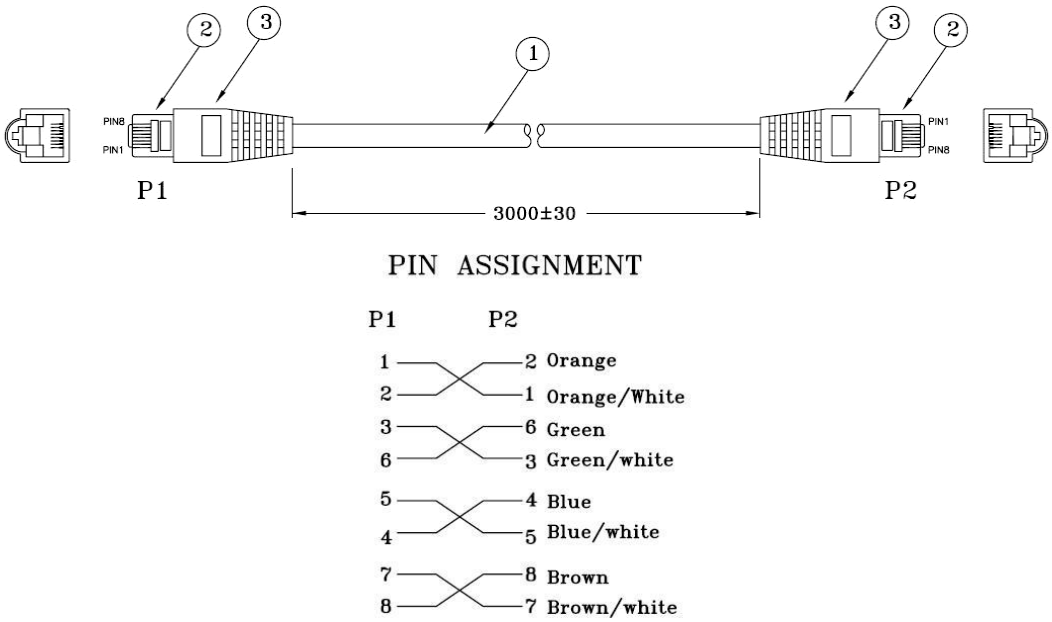

Figure B-3: STP Ethernet Cable Pinouts

B.4 DB-9 Serial Port

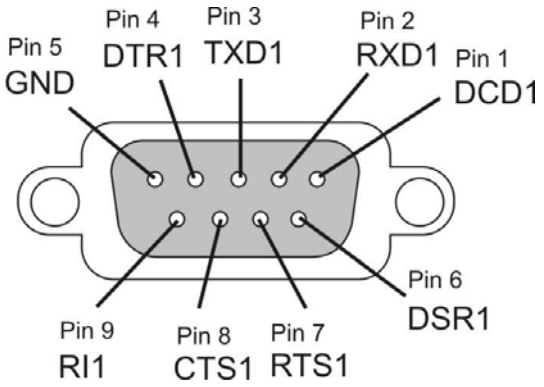

Figure B-4: COM1 Serial Port

Pin	Pin Name	Description
1	DCD1	Data Carrier Detect
2	RXD1	Receive Data
3	TXD1	Transmit Data
4	DTR1	Data Terminal Ready
5	GND	Ground
6	DSR1	Data Set Ready
7	RTS1	Request to Send
8	CTS1	Clear to Send
9	RI1	Ringing indicator

Table B-3: Serial Port Pinout Definitions

For a single-controller system, there is no included cable for this serial port. The serial cable is user-supplied.

B.5 Serial Port Y-Cable

The DB-9 to DB9 Y-cable connects the COM1 serial ports on redundant RAID controllers for maintenance-free terminal connection during controller failover/failback.

IFT-9373AYCab

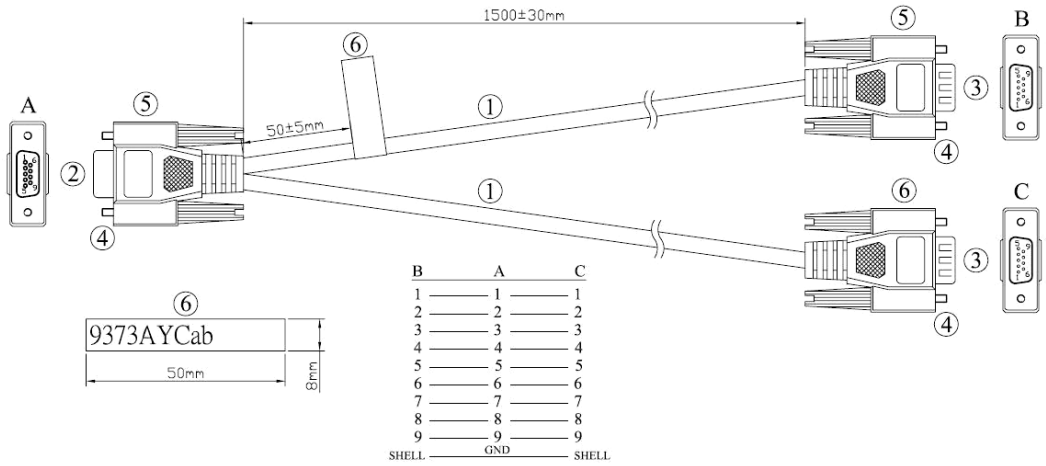

Figure B-5: Serial Port Y-Cable

B.6 SAS Expansion Port Pinouts

The Mini SAS expansion port complies with SFF-8088 specifications.

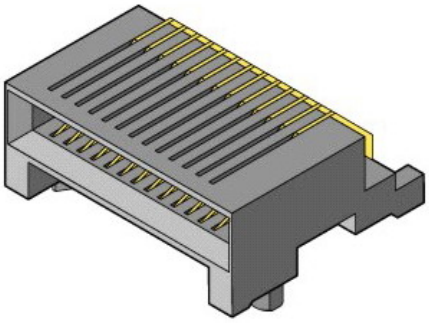

Figure B-6: Mini SAS SFF-8088 Connector

Pin	Description	Pin	Description
A1	GND	**B1**	GND
A2	RX0+	**B2**	TX0+
A3	RX0-	**B3**	TX0-
A4	GND	**B4**	GND
A5	RX1+	**B5**	TX1+
A6	RX1-	**B6**	TX1-
A7	GND	**B7**	GND
A8	RX2+	**B8**	TX2+
A9	RX2-	**B9**	TX2-
A10	GND	**B10**	GND
A11	RX3+	**B11**	TX3+
A12	RX3-	**B12**	TX3-
A13	GND	**B13**	GND

Table B-4: SAS Expansion Port Pinout Definitions

B.7 Power

IEC-type receptacles. Unless specified otherwise, cable type will be determined by the shipped-to area.